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LifeCare®  
**ELECTRONIC FLOW CONTROL**

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**TECHNICAL SERVICE MANUAL**

**LIFECARE® 4200  
PCA INFUSER**

**Abbott Laboratories  
Hospital Products Division**

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# TECHNICAL SERVICE MANUAL

## LIFECARE® 4200

### PCA INFUSER

## TABLE OF CONTENTS

1.0	INTRODUCTION	1-1
2.0	SPECIFICATIONS	2-1
3.0	SYSTEM OPERATING MANUAL	3-1
4.0	THEORY OF OPERATION	4-1
4.1	OPERATIONAL OVERVIEW	4-1
4.2	CIRCUITRY OVERVIEW	4-2
4.2.1	Microprocessor	4-2
4.2.2	RAM and ROM	4-3
4.2.3	Real-Time Clock and External RAM	4-3
4.2.4	Input/Output	4-4
4.2.5	I/O Address Decoding	4-4
4.2.6	LCD Display Circuit	4-4
4.2.7	LED Display Circuit	4-5
4.2.8	A/D Converter	4-5
4.2.9	Motor and Drivers	4-5
4.2.10	Motor Rotation Sensor	4-5
4.2.11	Pressure Measuring System	4-6
4.2.12	Alarms	4-6
4.2.13	Messages and Alarms	4-6
4.2.14	Silencing and Clearing Alarms	4-7
4.2.15	Power Supplies	4-10
4.2.16	Watchdog Circuit	4-10
4.2.17	Battery Monitor Circuits	4-11
4.3	POWER OFF MODES	4-11
4.4	POWER UP MODES	4-12

<b>5.0 MAINTENANCE AND CHECKOUT PROCEDURES .....</b>	<b>5-1</b>
5.1 PREVENTIVE MAINTENANCE .....	5-1
5.2 FIELD CHECKOUT PROCEDURES .....	5-2
5.2.1 The Test Port .....	5-2
5.2.2 Service Test Mode .....	5-3
5.2.3 Safety Tests .....	5-6
<b>6.0 FIELD SERVICE AND REPAIR .....</b>	<b>6-1</b>
6.1 TROUBLESHOOTING .....	6-1
6.1.1 Preliminary Inspection .....	6-1
6.1.2 Troubleshooting Guide .....	6-2
6.2 DISASSEMBLY INSTRUCTIONS .....	6-8
6.2.1 Chassis Disassembly .....	6-8
6.2.2 Reassembly Instructions .....	6-9
6.2.3 Service Tests .....	6-9
6.2.4 Battery Charger Circuit .....	6-9
6.2.5 Safety Test .....	6-9
6.3 BATTERY REPLACEMENT PROCEDURE .....	6-9
6.4 BATTERY MAINTENANCE .....	6-9
<b>7.0 SAFETY/SECURITY FEATURES .....</b>	<b>7-1</b>
7.1 ELECTRONICS .....	7-1
7.2 MECHANICAL FEATURES .....	7-1
<b>8.0 USER QUALIFICATION .....</b>	<b>8-1</b>
<b>9.0 WARRANTY .....</b>	<b>9-1</b>
<b>10.0 DRAWINGS AND COMPONENT PARTS LISTS .....</b>	<b>10-1</b>
10.1 SYMBOLS AND ABBREVIATIONS .....	10-1
10.2 TITLE BLOCK .....	10-1
10.3 ORDERING REPLACEMENT PARTS .....	10-2
10.4 RECOMMENDED SPARE PARTS .....	10-2
10.5 DRAWING LIST .....	10-3

## LIST OF TABLES

<b>Table 4-1</b>	Status Message Definitions .....	4-7
<b>Table 4-2</b>	Infusion Alarm/Action Table .....	4-8
<b>Table 5-1</b>	D15 Connector Pin Assignments .....	5-2
<b>Table 6-1</b>	Troubleshooting Guide .....	6-3
<b>Table 10-1</b>	Cross-Index of Drawing Titles to Document Numbers ..	10-3
<b>Table 10-2-1</b>	Power Supply Assembly .....	10-14
<b>Table 10-2-2</b>	Power Supply Assembly .....	10-16
<b>Table 10-3</b>	CPU/Display Assembly .....	10-22
<b>Table 10-4</b>	Rear Case Assembly .....	10-30
<b>Table 10-5</b>	Pole Clamp Assembly .....	10-34
<b>Table 10-6</b>	Pole Clamp Assembly .....	10-34
<b>Table 10-7</b>	Transformer/Receptacle Assembly .....	10-40
<b>Table 10-8</b>	LCD Display Assembly .....	10-42
<b>Table 10-9</b>	Electronics Assembly .....	10-44
<b>Table 10-10</b>	Front Case Assembly .....	10-48
<b>Table 10-11</b>	Slide Assembly .....	10-50
<b>Table 10-12</b>	Transformer Assembly .....	10-52

## LIST OF ILLUSTRATIONS

<b>Figure 5-1</b>	Locating the Test Port .....	5-3
<b>Figure 5-2</b>	To Enter the Service Test Mode .....	5-4
<b>Figure 6-1</b>	Chassis Disassembly .....	6-8
<b>Figure 10-1</b>	Block Diagram .....	10-5
<b>Figure 10-2</b>	System Interconnect Schematic .....	10-7
<b>Figure 10-3</b>	Power Supply Schematic .....	10-9
<b>Figure 10-3-1</b>	Power Supply Assembly .....	10-13
<b>Figure 10-4</b>	CPU/Display Schematic .....	10-17
<b>Figure 10-4-1</b>	CPU/Display Assembly .....	10-19
<b>Figure 10-5</b>	Rear Case Assembly .....	10-23
<b>Figure 10-6</b>	Pole Clamp Assembly .....	10-29
<b>Figure 10-7</b>	Control Panel Assembly .....	10-31
<b>Figure 10-8</b>	Transformer/Receptacle Assembly .....	10-35
<b>Figure 10-9</b>	LCD Display Assembly .....	10-39
<b>Figure 10-10</b>	Electronics Assembly .....	10-41
<b>Figure 10-11</b>	Front Case Assembly .....	10-43
<b>Figure 10-12</b>	Slide Assembly .....	10-47
<b>Figure 10-13</b>	Transformer Assembly .....	10-49

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# 1.0 Introduction

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## 1.0 INTRODUCTION

The LifeCare® 4200 PCA Infuser Technical Service Manual provides a convenient technical reference for the Patient-Controlled Analgesia Infuser available from Abbott Laboratories. This Service Manual is intended for use by a service technician qualified by Abbott Laboratories for troubleshooting and repair.

The Technical Service Manual is organized into ten sections:

- Section 1.0, Introduction
- Section 2.0, Specifications
- Section 3.0, System Operating Manual
- Section 4.0, Theory of Operation
- Section 5.0, Maintenance and Checkout Procedures
- Section 6.0, Field Service and Repair
- Section 7.0, Safety/Security Features
- Section 8.0, User Qualification
- Section 9.0, Warranty
- Section 10.0, Drawings and Component Parts Lists

A LifeCare® 4200 PCA Infuser System Operating Manual is included in Section 3.0 as supplementary information.

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## 2.0 Specifications

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## 2.0 SPECIFICATIONS

<b>DRUG SELECTION AND CONCENTRATION SETTINGS:</b>	1-10 mg/mL, (in 0.1 mg/mL increments)
<b>DELIVERY RATE:</b>	
PCA Mode:	Approximately 1 mL in 35 seconds
CONTINUOUS Mode:	Variable from 0.5 x Concentration (mg/hr) to 20.0 x Concentration (mg/hr)
PCA+CONTINUOUS Mode:	Variable from 0.5 x Concentration (mg/hr) to 20.0 x Concentration (mg/hr), + PCA dose (mg)
<b>KVO RATE:</b>	CONTINUOUS and PCA+CONTINUOUS, 0.1 mL/hr
<b>VOLUMETRIC ACCURACY:</b>	± 5%
<b>LOCKOUT INTERVAL RANGE:</b>	5 to 100 minutes in 1-minute increments.
<b>BACKPRESSURE LIMIT:</b>	100 ± 35 kPa
<b>OPERATING ENVIRONMENT:</b>	10° to 40° C ambient temperature 5 to 95% relative humidity, noncondensing.
<b>POWER INPUT:</b>	220-240V~, 50/60 Hz, 25VA (Japan: 100V~, 50/60 Hz, 30 W)
<b>POWER FUSES:</b>	220/240V, 0.16A, 250V, time lag (Japan: 100V, 500 mA, 250V, time lag)

<b>POWER CORD:</b>	International Electrotechnical Commission, IEC 601-1, approved cordset. Length: 2.5 ± 0.5 meters. (Japan: Transparent hospital-grade plug and retainer plate. Length 2.5 ± 0.5 meters.)
<b>BATTERY:</b>	One 8 Vdc, 2.5 ampere-hour, 4-cell sealed lead-acid rechargeable battery pack. A fully charged new battery will provide at least four hours of operation at a delivery rate setting of 20 mg/hr. Operating time increases with lower rate settings.
<b>ELECTRICAL LEAKAGE:</b>	Case to ground, less than 25µA; patient connections, less than 10µA.
<b>IEC 601-1 CLASSIFICATION:</b>	Class 1, Type B (U.K., Europe and Japan), Type BF (Australia), drip-proof, disinfectable. Not to be used in the presence of flammable anesthetics.
<b>DIMENSIONS:</b>	21 cm wide x 34 cm high x 15 cm deep
<b>WEIGHT:</b>	7 kg
<b>ADMINISTRATION SETS:</b>	Use only compatible Abbott PCA Sets with integral Anti-Siphon valve
<b>SYRINGE:</b>	Becton-Dickinson #9662, 30 mL, Luer Lock

## 3.0 System Operating Manual

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### **3.0 SYSTEM OPERATING MANUAL**

A copy of the LifeCare 4200 PCA Infuser System Operating Manual is included for reference in this section of the Service Manual. The Operating Manual contains instructions for using the PCA Infuser, as well as information used for troubleshooting.

Two English versions of the LifeCare 4200 PCA Infuser System Operating Manual are available. The manual enclosed is written for U.K. and European specifications (Part #430-04345). Also available is an Australian version (Part #430-04362).

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**LIFECARE® PUMP  
Model 4200 PCA INFUSER**

**F782-36-01/02  
F782-54-01/02**

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**SYSTEM OPERATING  
MANUAL**

**Abbott Laboratories  
North Chicago, IL 60064 USA**

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**430-04345-003**

**International**

**LIFECARE PUMP  
MODEL 4200 PCA INFUSER  
SYSTEM OPERATING MANUAL**

**CONTENTS**

<b>1.0</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	USER QUALIFICATION	1
1.2	INFUSER CHECKOUT	1
<b>2.0</b>	<b>EQUIPMENT DESCRIPTION</b>	<b>2</b>
2.1	ILLUSTRATIONS AND NOMENCLATURE	2
2.2	FRONT PANEL TOUCHSWITCH FUNCTIONS	4
2.2.1	Purge System	4
2.2.2	Loading Dose	5
2.2.3	Yes/Enter	5
2.2.4	Review/Change	5
2.2.5	▲ (Up Arrow), ▼ (Down Arrow)	5
2.2.6	I "On"	5
2.2.7	O "Off"/Rechg	5
2.2.8	Silence/No	5
2.2.9	Reset/Start	6
2.2.10	Print	6
2.2.11	History	6
<b>3.0</b>	<b>OPERATING INSTRUCTIONS</b>	<b>7</b>
3.1	TO SET UP THE INFUSER	7
3.2	TO PURGE THE SYSTEM	8
3.3	TO PROGRAM THE INFUSER	8
3.4	4-HOUR DOSE LIMIT	8
3.5	STARTING INFUSION	9
3.5.1	With Door Open	9
3.5.2	With Door Closed	9
3.5.2.1	<i>In PCA Mode</i>	9
3.5.2.2	<i>In CONTINUOUS Mode</i>	9
3.5.2.3	<i>In PCA+CONTINUOUS Mode</i>	9
3.6	CHANGING SETTINGS	9
3.6.1	During Setup	9
3.6.2	After Setup	9
3.7	CLEARING TOTAL DELIVERED	10
3.8	CHANGING TIME AND DATE	10
3.9	STOP INFUSION	10

<b>4.0 MESSAGES AND ALARMS .....</b>	<b>11</b>
<b>4.1 STATUS MESSAGES .....</b>	<b>11</b>
<b>4.2 ALARM SYSTEM .....</b>	<b>11</b>
<b>4.2.1 Silencing And Clearing Alarms .....</b>	<b>12</b>
<b>5.0 OPERATIONAL PRECAUTIONS .....</b>	<b>14</b>
<b>6.0 MAINTENANCE .....</b>	<b>15</b>
<b>7.0 HAZARDS .....</b>	<b>15</b>
<b>8.0 SPECIFICATIONS .....</b>	<b>16</b>
<b>9.0 RECOMMENDED PCA SETS AND SYRINGE .....</b>	<b>19</b>
<b>9.1 SETS FOR USE IN PCA MODE .....</b>	<b>19</b>
<b>9.2 SET FOR USE IN CONTINUOUS OR PCA+CONTINUOUS MODES .....</b>	<b>19</b>
<b>9.3 SYRINGE .....</b>	<b>19</b>
<b>10.0 WARRANTY .....</b>	<b>19</b>

# 1.0 INTRODUCTION

Patient-Controlled Analgesia (PCA) has been proven an effective and efficient protocol for administration of analgesic drugs. Under this protocol, the physician prescribes maximum dose rates and limits for analgesia, and the patient is permitted to self-administer the drug within the prescribed bounds.

The LifeCare Pump Model 4200 PCA Infuser makes possible the practical implementation of this protocol. The health care professional sets the prescribed dose, rates, and limits for the drug to be infused. The Infuser can then be set to operate in one of three modes:

- **PCA Mode**--in which the Infuser is programmed to administer a drug upon patient demand (within prescribed limits: PATIENT DOSE, LOCKOUT INTERVAL, and 4-HOUR DOSE LIMIT).
- **CONTINUOUS Mode**--in which the Infuser is programmed to administer a drug continuously (within prescribed limits: DOSE RATE and 4-HOUR DOSE LIMIT).
- **PCA+CONTINUOUS Mode**--in which the Infuser is programmed to administer a continuous dosage while the patient can control supplementary doses. The combination is managed by Infuser software (within prescribed limits for: PATIENT DOSE, LOCKOUT INTERVAL, DOSE RATE, and 4-HOUR DOSE LIMIT).

This manual provides complete Infuser descriptions and instructions for setting all three operating modes.

The LifeCare Pump Model 4200 PCA Infuser is designed with a number of mechanical, electrical, and software safeguards that prevent patient injury or drug abuse. These safeguards are discussed in detail at appropriate places in the text.

## 1.1 USER QUALIFICATION

The LifeCare Pump Model 4200 PCA Infuser is for use by licensed physicians or licensed/certified health care professionals who are trained in the use of the Infuser and in the administration of medical fluids. Use of the LifeCare Pump Model 4200 PCA Infuser by other than physicians or health care professionals should only be undertaken following proper instruction, training, and qualification of the user. Such use must be authorized in writing by a physician.

## 1.2 INFUSER CHECKOUT

Infuser unpacking, checkout, and periodic maintenance and repair should be performed by a resident Biomedical Engineer or technician using an Abbott Service Manual. If a program for periodic checkout is not in place, it is recommended that one be implemented.

## 2.0 EQUIPMENT DESCRIPTION

### 2.1 ILLUSTRATIONS AND NOMENCLATURE

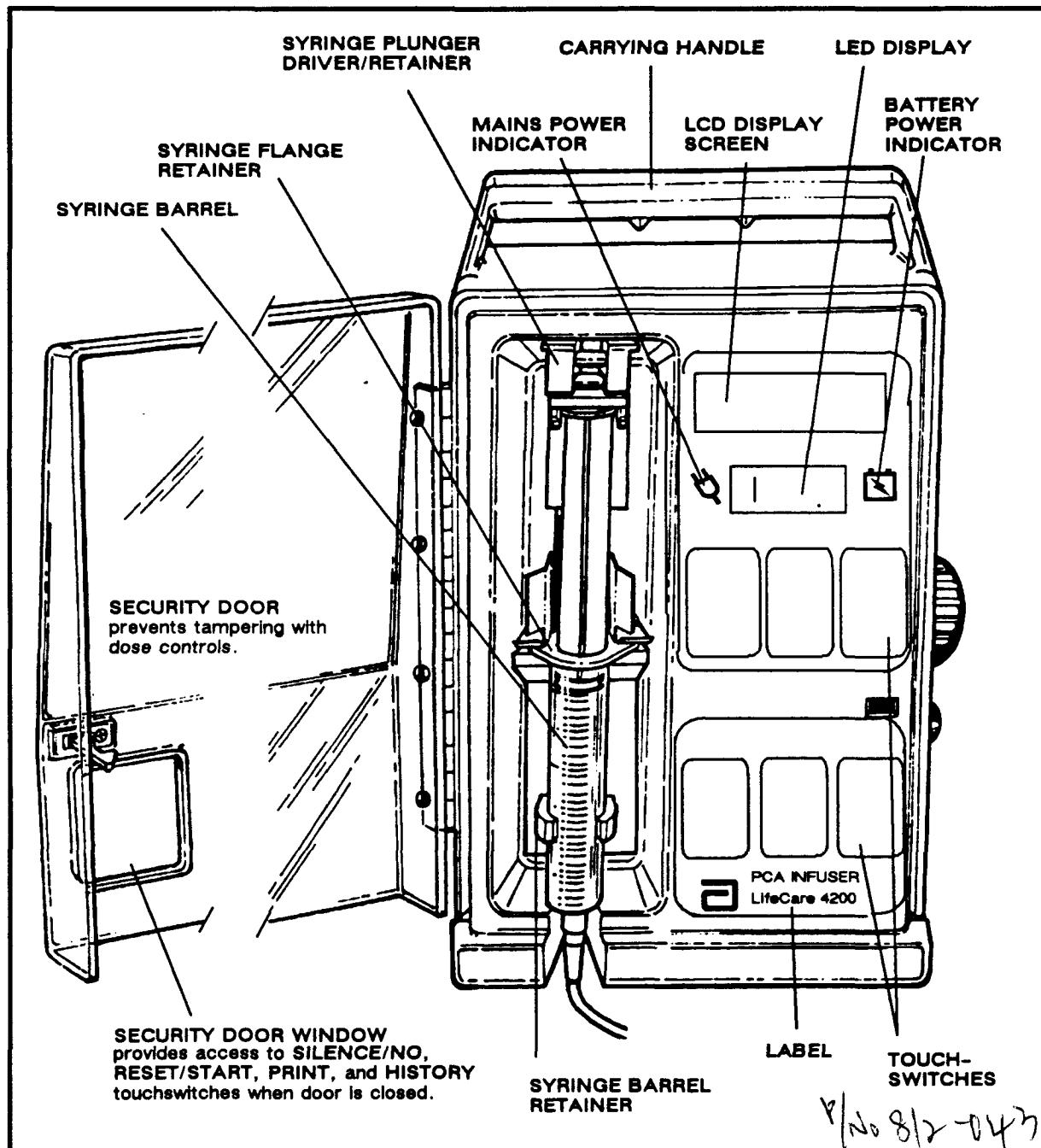


Figure 2-1. Front View

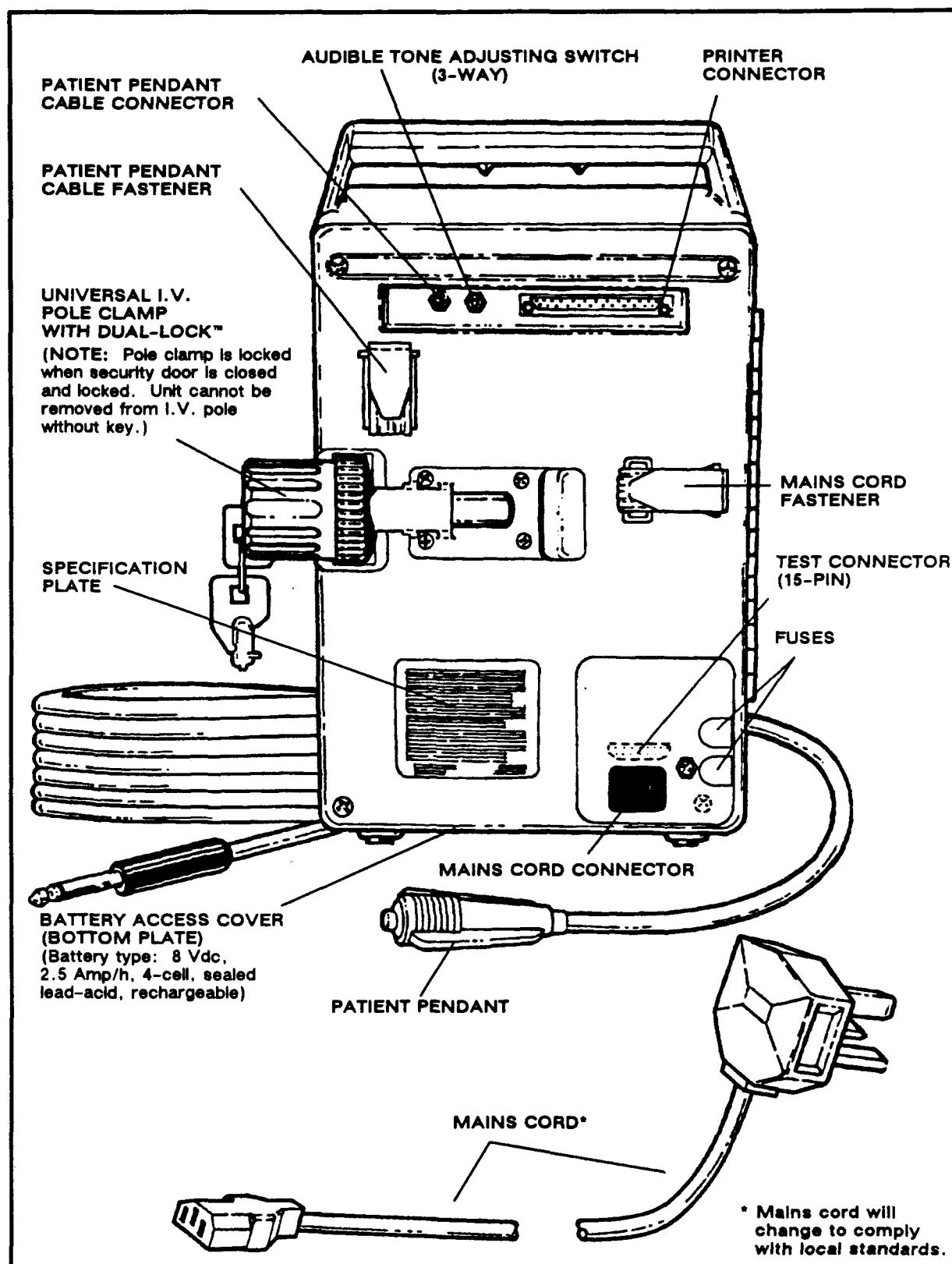


Figure 2-2. Rear View

## 2.2 FRONT PANEL TOUCHSWITCH FUNCTIONS

The LifeCare Pump Model 4200 PCA Infuser is programmed using the front panel touchswitches shown in Figure 2-3 and described below.

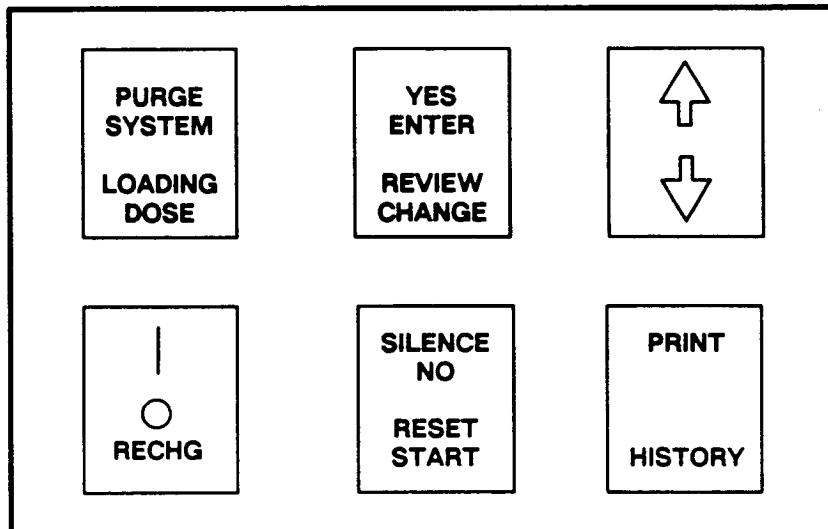


Figure 2-3. Front Panel Touchswitches

### NOTES FOR ALL TOUCHSWITCHES:

- Touchswitches are momentary contact switches which, when pressed, produce a brief audible tone along with a message or action.
- Inactive or incorrect touchswitches produce a fluttering audible tone when pressed.
- In door-locked condition, pressing a touchswitch automatically backlights LCD display. Backlight turns off after 2 minutes of no switch activity.

**CAUTION: DO NOT USE SHARP OBJECTS, SUCH AS PENS, SCISSORS, OR FINGERNAILS, TO PRESS TOUCHSWITCHES. SUCH OBJECTS WILL DAMAGE TOUCHSWITCHES AND CAUSE A MALFUNCTION.**

### 2.2.1 Purge System

**WARNING: TO ASSURE PATIENT SAFETY, THE ADMINISTRATION SET MUST BE DISCONNECTED FROM PATIENT BEFORE STARTING A PURGE CYCLE.**

Press and hold the PURGE SYSTEM touchswitch until a "Completion" prompt is displayed, or until fluid appears distally. The purge cycle is used to purge the system each time a syringe is loaded into the Infuser. If necessary, the purge cycle may be repeated once. Follow operator prompting messages while purging.

<b>2.2.2</b> <b>Loading Dose</b>	The <b>LOADING DOSE</b> touchswitch is used to initiate a loading or booster dose. If a supplemental dose(s) (booster dose) is required during Infuser operation, this switch may be used to re-enter the loading dose sequence.
<b>2.2.3</b> <b>Yes</b> <b>Enter</b>	This touchswitch serves two functions:
	<ul style="list-style-type: none"> <li>● In response to a "Yes" or "No" query message, pressing this touchswitch enters a YES answer.</li> <li>● In response to an "Enter" prompt, pressing this touchswitch confirms and enters user-selected data.</li> </ul>
<b>2.2.4</b> <b>Review</b> <b>Change</b>	Pressing <b>REVIEW/CHANGE</b> during setup displays the previous screen to allow for corrections or changes. Pressing <b>REVIEW/CHANGE</b> after mode setup provides an opportunity to review and/or change settings, clear total drug delivered, or reset time and date.
<b>2.2.5</b>  (Up Arrow)  (Down Arrow)	Pressing  (up arrow) or  (down arrow) increases or decreases the numerical value displayed. If the touchswitch is pressed and released repeatedly, the numbers scroll one number at a time. Pressing and holding the touchswitch speeds the scrolling rate. Brief pauses occur at intervals of 5 and 10 to permit review of the information.
<b>2.2.6</b> <b>I "On"</b>	Pressing the <b>I (ON)</b> touchswitch activates one of two start sequences:
	<ul style="list-style-type: none"> <li>● A cold start sequence occurs when the Infuser has been off for more than 60 minutes or if the <b>OFF/RECHG</b> touchswitch had been pressed and held until the display grid disappeared. A double audible tone (Morse Code AA, ".- .-") sounds in this sequence. All prescription settings and dose history are cleared and the Infuser is placed in the setup mode.</li> <li>● A warm start sequence occurs when the Infuser has been off for less than 60 minutes. No audible tone sounds in this sequence. All prescription settings and history are retained and the Infuser is set to start.</li> </ul>
<b>2.2.7</b> <b>O "Off"/Rechg</b>	Momentarily pressing and releasing <b>O/RECHG</b> turns the Infuser off while retaining memory, dose history, and settings for 60 minutes. If <b>O/RECHG</b> is pressed and held until display grid disappears, memory, previous settings, and dose history are cleared.
<b>2.2.8</b> <b>Silence</b> <b>No</b>	This touchswitch serves two functions:
	<ul style="list-style-type: none"> <li>● During an alarm, pressing <b>SILENCE/NO</b> temporarily mutes the audible alarms—except for the MALFUNCTION, CHECK BARREL, CHECK PLUNGER, and CHECK SYRINGE alarms, which cannot be silenced.</li> <li>● Following a "Yes/No" prompt request, pressing <b>SILENCE/NO</b> inputs a NO answer.</li> </ul>

## 2.2.9 Reset Start

Pressing **RESET/START** begins infusion in CONTINUOUS or PCA+CONTINUOUS Mode when the security door is closed and locked. Pressing this touchswitch during CONTINUOUS or PCA+CONTINUOUS infusion stops the infusion. After 5 minutes in the **RESET** state, an audible tone sounds. Pressing the **RESET/START** touchswitch again restarts infusion.

**Note:** This touchswitch is not active in PCA Mode.

## 2.2.10 Print

To use the print function:

- Connect a compatible printer.
- Turn on power switch at printer.
- Press **PRINT** to obtain a printout of settings, dose history, and event log.

**Note:** To stop printer, press **PRINT** while printing.

## 2.2.11 History

The **HISTORY** touchswitch has two functions:

- Press **HISTORY** after dose setup is completed to review current settings.
- Press **HISTORY** repeatedly to review settings, dose history, and event log. Approximately 8 seconds after the key is last pressed, the display screen returns to current display.

## 3.0 OPERATING INSTRUCTIONS

### 3.1 TO SET UP THE INFUSER

**Note:** Use only Becton-Dickinson 30 mL Luer Lock Syringe (List #9662) with the LifeCare Pump Model 4200 PCA Infuser.

Use of Abbott LifeCare PCA Sets with Integral Anti-Siphon Valve is recommended with the LifeCare Pump Model 4200 PCA Infuser.

Operating the PCA Infuser involves two general steps:

- Physical setup
- Programming dose, rates, and limits

1. Secure the PCA Infuser to I.V. pole using the Dual-Lock mechanism.  
**Note:** The key-controlled security door locks the pole clamp when door is locked, to prevent removal of Infuser without the key.
2. Plug the Mains cord into a properly earthed ac receptacle for ac-powered operation. The front panel will display a lighted plug symbol indicating ac connection.  
If ac power is in doubt or unavailable, the Infuser can be operated on internal battery power. The front panel will display a lighted battery symbol indicating battery operation.
3. Connect an appropriate Abbott PCA Set (see Section 9.0 for recommended sets) to a prefilled Becton-Dickinson 30 mL Luer Lock Syringe (List #9662), and prime.
4. Unlock and open Infuser security door.
5. Raise syringe plunger driver to uppermost position by pinching the driver-release mechanism together and lifting it up (see Figure 2-1).
6. Mount syringe in syringe retainer mechanism. Make sure the syringe flange fits into flange retainer, and the syringe barrel is pushed into barrel retainer.
7. Press I, if Infuser is not already on. At turn-on, the Infuser performs a self test ending with a "Test Complete" message displayed on the LCD display panel. If a "Malfunction" message appears, do not use Infuser.

### 3.2 TO PURGE THE SYSTEM

**WARNING: PATIENT MUST BE DISCONNECTED FROM PCA  
SET WHEN PERFORMING THE PURGE CYCLE.**

1. After a positive response to a "Purge" prompt, a purge cycle is initiated by pressing and holding the PURGE SYSTEM touchswitch until fluid is seen at the distal end of the PCA set. As soon as fluid flow is seen, release the PURGE SYSTEM touchswitch.

**Note:** Each time a syringe is installed or replaced, it is recommended that the system be purged using the PURGE SYSTEM touchswitch.
2. Connect primed PCA set to indwelling venipuncture device.

### 3.3 TO PROGRAM THE INFUSER

Having completed the steps above, follow the operator prompts on the display screen to:

- Set drug concentration.
- Select loading dose (YES or NO).
- Select mode of operation: PCA, CONTINUOUS, or PCA+CONTINUOUS.
- Select PCA dose and/or continuous rate.
- Select 4-hour dose limit (YES or NO).
- Select lockout interval.
- Review settings by pressing HISTORY.
- Close and lock door.
- Press START (or, in PCA-only Mode, give patient pendant to patient).

**Note:** When commencing administration in any mode, make sure all slide clamps are open on the PCA and I.V. line(s).

### 3.4 4-HOUR DOSE LIMIT

An optional 4-hour dose limit is provided for added safety to limit the amount of drug delivered in the PCA, CONTINUOUS, and PCA+CONTINUOUS Modes. The 4-hour limit is a physician-selected limit that is set when programming a series of doses. Its purpose is to limit the total amount that can be delivered in any 4-hour period.

When the sum of the doses in the rolling 4-hour period equals the 4-hour limit, delivery stops in PCA Mode and "4 hr lim reached" message appears. In the CONTINUOUS or PCA+CONTINUOUS Mode, the Infuser switches to a KVO rate of 0.1 mL/hr when the 4-hour limit is reached, and a "4 hr lim reached" message appears. As the oldest dose ages out of the 4-hour dose record, the Infuser will again accept dose requests and resume delivery.

## 3.5

### STARTING INFUSION

#### 3.5.1

##### With Door Open

Delivery can be initiated during setup or after setup by initiating a loading dose or booster dose respectively.

#### 3.5.2

##### With Door Closed

###### 3.5.2.1

###### *In PCA Mode*

A patient-initiated PCA DOSE can be administered using the patient pendant when the Infuser is in the READY state (\*\*). After completing the dose, the Infuser enters either the PATIENT LOCKOUT or the 4-HR LIMIT REACHED state (if it has been selected); further delivery is prohibited in both of these states. The RESET/START touchswitch is inactive in the PCA Mode.

###### 3.5.2.2

###### *In CONTINUOUS Mode*

Continuous infusion can be started by pressing RESET/START after the door is closed and locked. The patient pendant is disabled in this mode of operation. If selected, upon reaching the 4-HOUR DOSE LIMIT, the Infuser switches to a KVO rate of 0.1 mL/hr.

###### 3.5.2.3

###### *In PCA+CONTINUOUS Mode*

The infusion can be started by pressing the RESET/START touchswitch after the door is closed and locked. The patient-activated doses are now permitted if Infuser is in the READY state (\*\*) (after RESET/START pressed). When the patient-initiated dose is activated, the sum of PCA DOSE and CONTINUOUS RATE is delivered. After the PCA DOSE is completed, the Infuser enters either the PATIENT LOCKOUT or the 4-HR LIMIT REACHED state (if selected). In the PATIENT LOCKOUT state, the continuous infusion remains in progress, but the patient-initiated dose cannot be activated. In the 4-HR LIMIT REACHED state, the Infuser switches to a KVO rate of 0.1 mL/hr.

**Note:** In all modes of operation, delivery in progress (running) is displayed by a repetitive "walking" LED symbol.

## 3.6

### CHANGING SETTINGS

#### 3.6.1

##### During Setup

The Infuser settings can be changed either before or after the programming has been completed.

During setup, an entered setting can be changed simply by pressing REVIEW/CHANGE. Each time REVIEW/CHANGE is pressed, the message display will revert to the previous setting, until the first setting is displayed.

#### 3.6.2

##### After Setup

After setup is completed, press REVIEW/CHANGE to change Infuser settings. When the "Change Settings" prompt appears, press YES, then follow the prompts to select and change the settings.

### **3.7 CLEARING TOTAL DELIVERED**

To clear the total amount delivered and the total Loading Dose amount, first press REVIEW/CHANGE. Press NO when the "Change Settings" prompt appears, then press YES when the "Clear Total Delivered" prompt appears.

### **3.8 CHANGING TIME AND DATE**

To change the time and date, press REVIEW/CHANGE, then press NO at the "Change Settings" prompt and press NO again at the "Clear Total Delivered" prompt. The time and date will be displayed with a "Change?" prompt. Press YES, then press REVIEW/CHANGE to advance the flashing field to the one desired. Use the  $\leftarrow$  and  $\rightarrow$  touchswitches to change the value in the flashing field.

### **3.9 STOP INFUSION**

- To stop infusion in the PCA Mode, close the slide clamp, open the door and press the O/RECHG touchswitch.
- To stop infusion in the CONTINUOUS or PCA+CONTINUOUS Mode, close the slide clamp and press the RESET/START touchswitch or open the door and press the O/RECHG touchswitch.

## 4.0 MESSAGES AND ALARMS

The LifeCare Pump Model 4200 PCA Infuser is programmed to display messages or alarms for a number of defined operating conditions.

### 4.1 STATUS MESSAGES

Status messages displayed by the Infuser are defined in Table 4-1.

Table 4-1. Status Message Definitions

MESSAGE	DEFINITION
DOOR LOCKED	Displayed for 30 seconds when security door is closed and locked.
PATIENT LOCKOUT	Displayed after a successful patient-initiated dose delivery. The message remains until the LOCK-OUT INTERVAL elapses. This message appears only when the security door is locked in the PCA or PCA+CONTINUOUS Mode.
4 HR LIM REACHED	Displayed if 4-hour limit has been selected and reached with security door locked.
***	Indicates that patient can initiate a dose in PCA or PCA+CONTINUOUS Mode.
PCA	Displayed when Infuser is in PCA Mode.
CONTINUOUS	Displayed when Infuser is in CONTINUOUS Mode.
PCA+CONTINUOUS	Displayed when Infuser is delivering a PCA DOSE in the PCA+CONTINUOUS Mode.

### 4.2 ALARM SYSTEM

The Infuser features an alarm system that warns the user of a problem and helps identify the cause. The alarm actions are:

- Flashing message appears on the display with all alarms.
- A repetitive audible tone sounds with all alarms except MALFUNCTION, which is a continuous tone. The audible tone is adjustable to low, medium, or high sound levels by means of a switch located on the rear panel of the Infuser.
- The Infuser stops operating when these alarms occur: CHECK BARREL, CHECK PLUNGER, CHECK SYRINGE, EMPTY SYRINGE, OCCLUSION, and MALFUNCTION.

#### 4.2.1

#### Silencing And Clearing Alarms

TO SILENCE ANY LISTED ALARM, PRESS SILENCE/NO AND FOLLOW THE DISPLAYED PROMPTS.

The alarms are listed and explained in Table 4-2 along with instructions for clearing them.

Table 4-2. Infuser Alarm/Action Table

MESSAGE	MUTING PERIOD	POSSIBLE CAUSE	ACTION
CHECK BARREL (Audible delay 30 seconds)	None	Barrel is improperly installed or missing.	Properly insert the barrel in the barrel retainer.
CHECK PLUNGER (Audible delay 30 seconds)	None	Plunger improperly installed or missing.	Properly insert plunger in the driver/retainer assembly.
CHECK SYRINGE (Audible delay 30 seconds)	None	Syringe (barrel AND plunger) improperly installed or missing.	Properly insert plunger, barrel flange, and barrel in their proper retainers.
LOW SYRINGE	Indefinitely	3 to 4 mL of solution remaining in the syringe.	No action required; status message only.
EMPTY SYRINGE	15 minutes	The syringe is empty.	Open the security door if closed, and replace syringe or turn Infuser off.
CHECK SETTINGS	1 minute	The security door is closed and locked before setup is complete, or incorrect settings.	Open the door and make sure that all settings are proper.
CHECK 4-HR LIMIT	1 minute	The security door is closed and locked and 4-HOUR DOSE LIMIT is set less than PCA DOSE.	Make sure PCA DOSE is less than 4-HOUR DOSE LIMIT.
DOOR OPEN	2 minutes	The security door has been left open for more than 2 minutes without touchswitch activity.	Close and lock security door if all prescription parameters are entered or press SILENCE to clear the alarm.

Table 4-2. Infuser Alarm/Action Table (Continued)

MESSAGE	MUTING PERIOD	POSSIBLE CAUSE	ACTION
OCCLUSION*	1 minute	Kinked or occluded tubing, occluded venipuncture device or closed slide clamp.	Open security door, if closed. Relieve back-pressure by squeezing and releasing the syringe plunger driver/retainer. Identify the cause of occlusion and correct it.
INFUSER IN RESET†	5 minutes	Operator pressed RESET/START touchswitch when security door was locked (in CONTINUOUS or PCA+CONTINUOUS Mode) and delivery was in process.	Press the RESET/START touchswitch to resume operation.
LOW BATTERY (Battery symbol will flash)	10 minutes (for 2 times; cannot be silenced after 2 times)	Battery is near discharge level, approximately 30 minutes of battery life remaining.‡	Connect line cord to a properly earthed 220-240 Vac outlet or complete infusion in 30 minutes.
MALFUNCTION	None	Electronic circuit and/or software failure.	Note MALFUNCTION code displayed. Press O/RECHG touchswitch to silence alarm and turn Infuser off. Remove Infuser from service and refer it to qualified service personnel.

\* Note: There is a delay between the time an occlusion occurs and the time the occlusion alarm pressure is sensed. During that time, a bolus volume may be stored in the giving set. Follow the action procedure to prevent the bolus from being delivered to the patient.

† Note: "Infuser In Reset" message also appears after an alarm condition has been cleared. The operator should press RESET/START to resume operation.

‡ Note: Infuser will shut down after 30 minutes.

## 5.0 OPERATIONAL PRECAUTIONS

While using the Infuser, observe the following precautions:

- **ALWAYS CLOSE** slide clamp on PCA administration set before removing or replacing syringe, or discontinuing infusion.
- Use of an Abbott LifeCare PCA Set with Integral Anti-Siphon Valve (Backcheck Valve) is recommended to help prevent potential overdose.
- Use only compatible Abbott administration sets with LifeCare Pump Model 4200 PCA Infuser (see Section 9.0).
- Potent analgesic medications are used with this device. Refer to drug package insert for precautions and possible adverse reactions.
- Perform a purge cycle for each syringe change.

**IMPORTANT: BE SURE TO DISCONNECT ADMINISTRATION SET BEFORE STARTING A PURGE CYCLE.**

- Perform proper patient selection.
- Perform adequate patient monitoring at all times.
- **ALWAYS** connect Infuser to properly earthed, hospital-grade receptacle. If power source is in doubt, use battery power.
- **DO NOT** use sharp objects such as pens, pencils, scissors, fingernails, or paper clips to operate touchswitches.
- A **LOADING DOSE** is included in the **4-HOUR DOSE LIMIT** Calculation **ONLY** if the **4-HOUR DOSE LIMIT** function is activated during setup. The **LOADING DOSE** is always included in the **TOTAL DOSE DELIVERED**.
- A **LOADING DOSE** can always be delivered. If the **4-HOUR DOSE LIMIT** has been reached, using the **LOADING DOSE** function can result in exceeding the desired **DOSE LIMIT**.
- Use Abbott LifeCare PCA Set #6517 whenever the Infuser is in **CONTINUOUS** or **PCA+CONTINUOUS** Modes.
- To allow piggybacking of a KVO I.V. line into distal backcheck "Y" site to maintain patency of venipuncture device, use Abbott LifeCare PCA Set #3559, or #6514 and #6517 together, whenever Infuser is in PCA Mode.
- It is recommended that highly viscous solutions and drugs, colloidal suspensions and emulsions **NOT** be delivered through the inline backcheck valve on the KVO side of the PCA Set. Function of the valve may be compromised by presence of residue.
- Refer to analgesic package enclosure for possible incompatibility with fluid or drug being delivered through the KVO line.

## 6.0 MAINTENANCE

Establish a routine schedule for cleaning the Infuser case, front panel, and patient pendant. To clean the Infuser, proceed as follows:

- Turn off Infuser and disconnect power cord before cleaning.
- Clean security door, front panel, case, and patient pendant by wiping with soft cloth dampened with a mild solution of soapy water.

**CAUTION: DO NOT USE ABRASIVE CLEANERS, AS THEY MAY SCRATCH THE TRANSPARENT DOOR.**

**CAUTION: DO NOT STERILIZE BY HEAT, STEAM, ETO, OR RADIATION.**

**Note:** Do not immerse Infuser or patient pendant in liquid.

No other routine maintenance is required; the Infuser has NO user-serviceable parts. All servicing must be carried out by qualified technical personnel. See Service Manual for additional procedures that define periodic testing and calibration, if required.

## 7.0 HAZARDS

The LifeCare Pump Model 4200 PCA Infuser is an electro-mechanical instrument. To prevent injury to personnel or damage to the Infuser, observe the following safety precautions:

- Do not operate the Infuser with case opened. Refer servicing to qualified technical personnel.
- Do not immerse the Infuser in fluids.

**DANGER: POSSIBLE EXPLOSION HAZARD IF INFUSER IS USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS.**

## 8.0 SPECIFICATIONS

**Drug Concentration****Range Settings:**

1-10 mg/mL (in 0.1 mg/mL increments)

**Delivery Rate:****PCA Mode:**

Approximately 1 mL in 35 seconds

**CONTINUOUS Mode:**

Variable from 0.5 mg/hr to 200 mg/hr depending upon drug concentration

**Lockout Interval Range:**

5 to 100 minutes (in 1 minute increments)

8.435 - 19.58 ps

**Maximum Infusion Pressure:**100  $\pm$  35 kPa (760  $\pm$  266 mmHg) maximum**Occlusion Alarm Pressure:**100  $\pm$  35 kPa (760  $\pm$  266 mmHg) maximum**Occlusion Bolus Volume:**

Less than 1.5 mL (See Section 4.2 for correct response to occlusion alarm.)

**Occlusion Time to Alarm:**

Less than 5 minutes at a continuous delivery rate of 10 mL/hr

**Operating Environment:**

10 to 40°C (50 to 104°F) ambient temperature

5% to 95% relative humidity, noncondensing

**Power Requirements:**

220-240 V~, 50/60 Hz, 25 VA

**Fuse:**

0.125 ampere, 250 V~, time lag

**Battery:**

One 8 V---, 2.5 ampere-hour, 4-cell sealed lead-acid rechargeable battery pack. When fully charged, a battery will typically provide a minimum of 4 hours of operation.

**Note:** Gradual degradation over extended periods of use will decrease the operation capacity of the battery. When capacity drops to an unacceptable level, replace the battery. Battery replacement must be carried out by qualified technical personnel.

**Electrical Leakage:**  
(ungrounded)Case to ground, less than 25  $\mu$ A; Patient connections, less than 10  $\mu$ A**Electrical Safety:**

Meets IEC 601-1 standards for:

Class 1 (mains supply equipment using protective earth)

Type B



(equipment providing adequate degree of protection against electrical shock and suitable for application to the patient)

Drip Proof



(equipment protected against ingress of falling liquid)

Disinfectable (see Section 6.0)

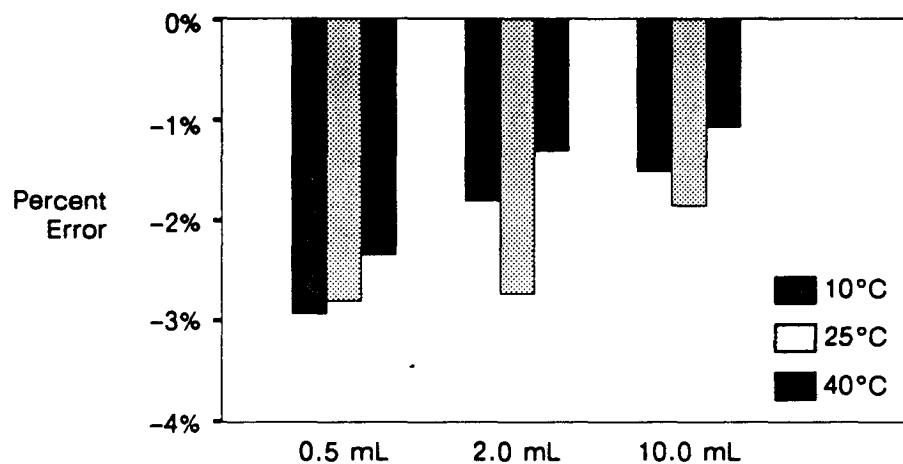
**Note:** NOT to be used in the presence of flammable anesthetics.

**Dimensions:** 21 cm x 34 cm x 15 cm  
**Weight:** 7 kg  
**Administration Sets:** Use only Abbott PCA administration sets with this Infuser.

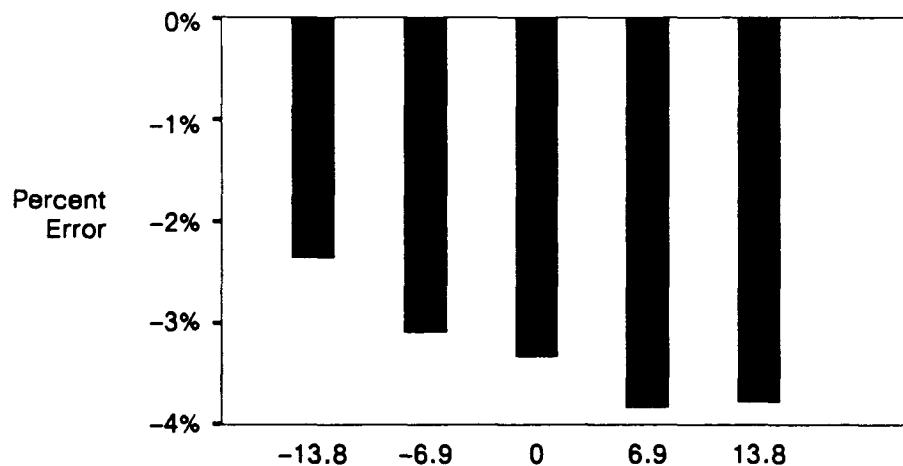
**Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI):**

The LifeCare Pump Model 4200 Infuser is designed to perform in the typical hospital environment. A qualified service technician should verify performance in any environment where EMI or RFI levels are excessive.

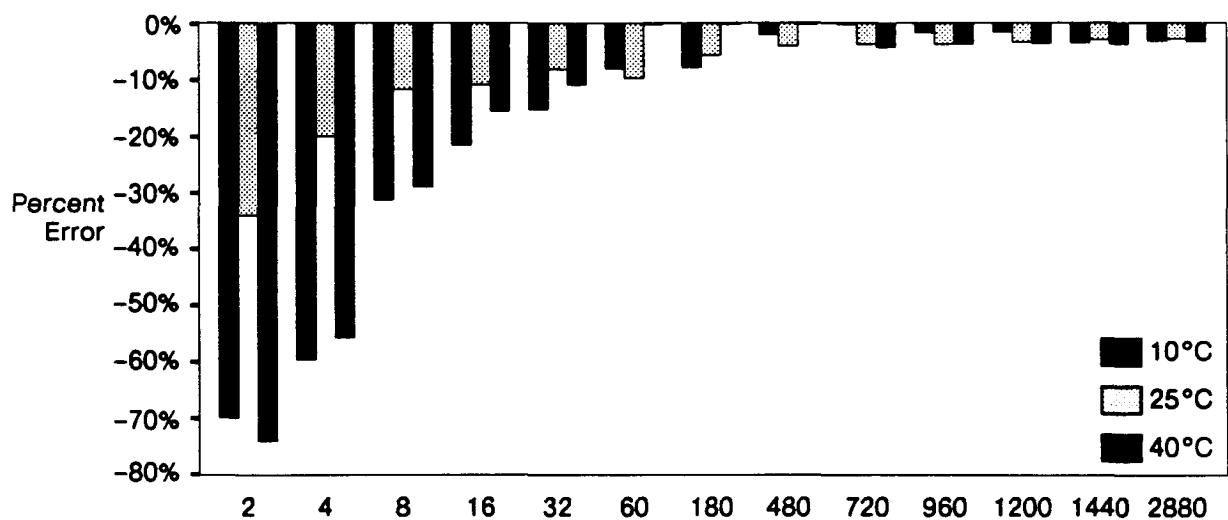
**Delivery Accuracy:**



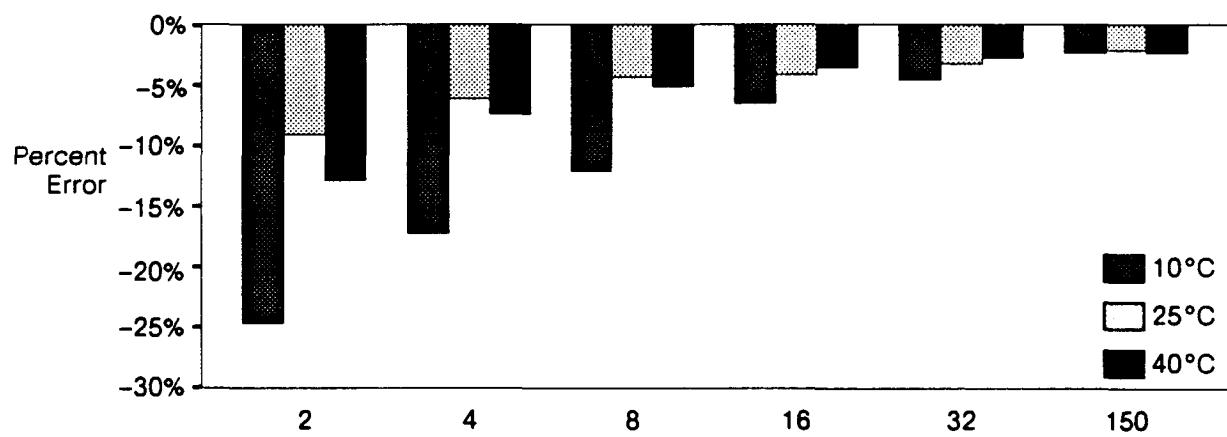
**Figure 8-1. Delivery Error in Percent of Single Loading or Patient Dose, at Three Temperatures**



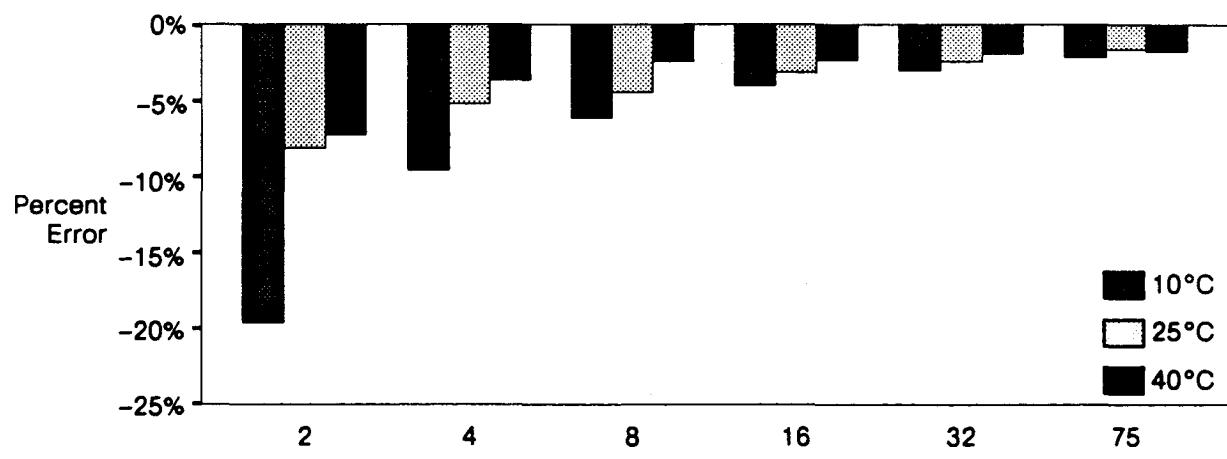
**Figure 8-2. Delivery Error in Percent of 0.5 mL Dose Versus Backpressure (kPa)**



**Figure 8-3. Delivery Error Over Time (Minutes) as a Percent of Total Dose Delivered During Continuous Delivery at 1.0 mL/h, at Three Temperatures**



**Figure 8-4. Delivery Error Over Time (Minutes) as a Percent of Total Dose Delivered During Continuous Delivery at 10 mL/h, at Three Temperatures**



**Figure 8-5. Delivery Error Over Time (Minutes) as a Percent of Total Dose Delivered During Continuous Delivery at 20 mL/h, at Three Temperatures**

## **9.0 RECOMMENDED PCA SETS AND SYRINGE**

The following sets are for use with the Model 4200 PCA Infuser. These sets are supplied sterile and are for single use only.

### **9.1 SETS FOR USE IN PCA MODE**

**List 3559: PCA Set, Mini-Bore with Integral Anti-Siphon Valve**

**List 6514: PCA Extension Set with Backcheck Valve-SL**

**Note:** List 6514 to be used in combination with List 6517, when converting from either CONTINUOUS Mode or PCA+CONTINUOUS Mode to PCA Mode.

**List 6516: PCA Set--Long, Mini-Bore, with Integral Anti-Siphon Valve-SL**

### **9.2 SET FOR USE IN CONTINUOUS OR PCA+CONTINUOUS MODES**

**List 6517: PCA Continuous Infusion Set, Mini-Bore, with Integral Anti-Siphon Valve-SL**

### **9.3 SYRINGE**

**Catalog 9662: Becton-Dickinson, 30 mL, Luer Lock**

## **10.0 WARRANTY**

The LifeCare Pump Model 4200 PCA Infuser has been carefully manufactured using high-quality components. The Infuser is warranted to be free from defects in material and workmanship under normal use and service for a period of 1 year from the date of purchase. On return to Abbott, the Infuser will be repaired or replaced within the terms of this warranty.

The warranty on the replaceable battery is limited to 90 days under normal use and service. Material returned to Abbott must be properly packaged and sent freight prepaid.

This warranty shall not apply if the Infuser has been repaired by anyone other than qualified service personnel, or altered in any way which, in Abbott's judgment, affects its stability or reliability, or if the serial number has been altered, effaced, or removed.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES  
EXPRESS OR IMPLIED.**

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**DANGER: POSSIBLE EXPLOSION HAZARD IF USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS.**

**IEC 601-1 Classification: Class 1, Type B, Drip-proof  
Medical Equipment**



**Attention, Consult Accompanying Documents**

**LifeCare is a registered trademark and Dual-Lock is a trademark of Abbott Laboratories.**



**ABBOTT Laboratories, North Chicago, Illinois 60064 USA**



## 4.0 Theory of Operation

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## 4.0 THEORY OF OPERATION

### 4.1 OPERATIONAL OVERVIEW

This section describes the theory of operation for the LifeCare® 4200 PCA Infuser. Related drawings are found in Section 10.0 and are cross-referenced where applicable.

The LifeCare 4200 PCA Infuser is a self-contained, microprocessor-based, electro-mechanical system which delivers analgesia with a Becton-Dickinson 30 mL Luer Lock syringe (List #9662) and an Abbott administration set. It incorporates touchswitch controls, a prompting alphanumeric display, a positive locking system with a transparent protective cover and a pole clamp, a rear connector for printing dose history, and a patient pendant for patient-controlled dosing. It can operate with a mains supply or an 8 Vdc lead-acid battery pack (included). Operation is constantly monitored by the microprocessor to detect any potential malfunction.

Operation of the PCA Infuser begins with a touch of the ON touchswitch, or by inserting (or removing) a syringe in the holder. Switches sense the presence (or the absence) of the syringe and begin the cold-start or warm-start sequence. This sequence includes a software-based self-test which checks RAM/ROM, the CPU, and the real-time clock. (See Sections 4.2.1 through 4.2.3.)

In Set-Up mode, prompting messages will appear on the LCD display leading the user through each step. Before the motor can be actuated to give either a loading dose or a patient-initiated dose, the user is prompted for dose volume information, which must be entered using the touchswitches.

The Infuser delivers drug by the mechanical displacement of fluid from a syringe. The delivery mechanism pushes the plunger into the barrel by means of a lead screw connected to the stepper motor shaft. The CPU calculates volume delivered as a function of shaft rotation. Volumetric error is less than  $\pm 5\%$  of the dose setting.

The motor is stepped by application of a standard four-phase sequential signal to the stepper motor drivers. Pump operation and shaft rotation are constantly monitored, as is the presence of the barrel/plunger. Any mechanical or electrical malfunction, or misplacement of barrel or plunger, will result in immediate stoppage of the Infuser and the sounding of an audible alarm.

Sensors provide input for the processor to monitor the door status, syringe drive back pressure, proper installation of barrel and syringe, syringe drive position low and empty syringe, power status (mains or battery operation), and low or charged status of the battery. This constantly monitored information is displayed on the LCD.

In Patient mode, a patient request for analgesia (under PCA or PCA+CONTINUOUS modes) is answered subject to the status of the lockout interval and the 4-hour dose limit. A dose is only delivered if the lockout interval has expired and the 4-hour dose limit has not been reached (the \*\*\* message will appear when a dose can be initiated). Timing for the lockout interval and 4-hour dose limit functions is maintained by the CPU and derived from crystal oscillation. System timing accuracy is constantly monitored by a separate hardware circuit (watchdog circuit) that will trigger a malfunction alarm in the event that processor timing changes from the nominal value.

## 4.2 CIRCUITRY OVERVIEW

The PCA Infuser electronic hardware is housed on two Printed Wiring Assemblies (PWA)—the CPU/Display PWA and the Power Supply PWA.

The major circuits on the CPU/Display PWA include:

- CPU, EPROM, A/D, and associated circuitry
- LCD and LED display circuitry
- Watchdog circuitry
- Touchswitch input
- Real-Time clock and RAM

The major circuits on the Power Supply PWA include:

- Motor, ac/dc, and logic power supply circuitry
- Battery charger and battery monitor circuitry
- Door and syringe position sensor circuitry
- Motor monitor and motor driver circuitry
- Printer port and test port
- ON/OFF latch and audio driver circuitry

The PWAs and various input/output devices are interconnected with a series of cable/connector assemblies. The interconnect and PWA schematics are in Section 10.0. They show all the electronic circuits in detail.

### 4.2.1 Microprocessor

The 8032AH IC (U11) is an 8-bit microcontroller, which has 256 bytes internal RAM, three 16-bit timers/counters, and two-level interrupt priority structure. Address/data lines AD0 through AD7 are multiplexed. The address latch enable (ALE, U11-30) and program store enable (PSEN, U11-29 low active) control the separation of the low byte address lines (A0)A7 and the data bus (D0-D7) through U13 (8-bit latch) and U12 (8-bit bus transceiver). Lines A8 through A15 are the high order address bits, which join the low order address bits (A0-A7) to form the system address bus.

The 10 MHz crystal Y1, capacitors C14 and C18, and active elements within U11 form the microcontroller clock. The internal clocking signals are at half the oscillator frequency, and define the internal phases, states, and machine cycles.

#### 4.2.2 RAM and ROM

The system memory consists of three areas mapped in the following way:

- The CPU has 256 bytes of internal Random Access Memory (RAM), divided into registers and scratch pad memory.  
Locations HEX 00 through 1F are assigned for bank-0 through bank-3.  
Locations HEX 20 through FF are used for scratch pad and stack area.
- Erasable Programmable Read-Only Memory (EPROM) is 64k bytes with code area mapped as hex 0000 through FFFE, while FFFF contains checksum. The Infuser program (firmware) is installed at U22, utilizing a 27C512 64k x 8 CMOS EPROM.
- External to the CPU is 8k bytes of scratch pad memory, mapped from hex 8000 to hex 9FFF. The 8K x 8 of nonvolatile memory in U21 has been mapped as locations HEX 8000-9FFF.

#### 4.2.3 Real-Time Clock and External RAM

The real-time clock, a DS1216 (U21), is a 28-pin DIP socket with a built-in CMOS timekeeper function and an embedded lithium energy cell to maintain time and date. It accepts a 28-pin memory device (such as 8K x 8 CMOS RAM in our Infuser). The main feature of this real-time clock IC is that the timekeeper function remains transparent to the memory device placed above. It monitors VCC for an out-of-tolerance condition. When such a condition occurs, the internal lithium energy source is automatically switched to prevent loss of data.

The lithium cell should maintain the calendar time for not more than 10 years in the absence of power. Time resolution to a hundredth of a second is possible. When A0 is set low, a 64-bit serial command requesting time information is shipped to the clock. The time is processed by the CPU and sent to the LCD for display.

The external RAM permanently stores patient pendant tone selection and the total running time of the Infuser.

#### 4.2.4 Input/Output

U7 on the Power Supply PWA is a programmable peripheral interface device with three 8-bit ports. These ports are programmable as input or output. The configuration is as follows:

<b>PORT A:</b>	<i>Output</i>	Controls the motor and LCD backlight
<b>PORT B:</b>	<i>Input</i>	Unused
<b>PORT C:</b>	<i>Input</i>	Monitors status of the printer, the door, the ON touchswitch, battery, barrel, plunger, and OFF touchswitch.

U11 (on the Power Supply PWA) acts as a buffer to latch data for output to the printer.

Touchswitch status is connected to the data bus by U4, a 74HC244 octal buffer/line driver device.

#### 4.2.5 I/O Address Decoding

Address decoding is handled by U6 on the CPU/Display PWA, a 74HCT138 octal decoder. Decoded addresses, CS0 through CS7, are used to select one of the following:

CS0 00-0F is SWSTSEL to U8 on Power Supply PWA  
CS1 10-1F is LCD (DS9) select  
CS2 20-2F is printer data select  
CS3 30-3F is LED display select  
CS4 40-4F is analog to digital conversion  
CS5 50-5F is the programmable peripheral interface select  
CS6 60-6F is touchswitch select  
CS7 70-7F is unused

#### 4.2.6 LCD Display Circuit

The 4 x 16 liquid crystal display (LCD) is of the transreflective type and is backlit by an electroluminescent panel (ELP). The ELP is powered by a 5 Vdc to 90 Vac converter (U17). The ELP backlighting is turned off 30 seconds after the security door is locked. Backlighting temporarily occurs during touchswitch operation and is automatically turned off after about 2 minutes with no activity. On-board circuitry handles all the necessary functions, such as LCD drive and refresh, to display the information.

U10 is a dc/dc power converter. Combined with C11, C5, and C6, a negative 5 Vdc source is generated at U10. This negative 5V power source is used to select the LCD viewing angle through the adjustment of the trimpot (R19).

#### **4.2.7 LED Display Circuit**

The LED display consists of an array of five HDSP-7503 seven-segment light-emitting diodes and a single LED at DS6, used as the decimal point. The LED displays in hundreds, tens, units, and tenths of a unit. DS2, used as a pumping indicator, uses three segments which are lit successively.

The segments are driven by a 74HCT373 latch (U14) and two transistor arrays (U8 and U9). Input to U14 is the system data bus. Digit drive is selected by address A0 through A3 through latch U2 and transistor array U3.

Power for the mains symbol is routed directly from the bridge rectifier on the Power Supply PWA through current-limiting resistor R14. The symbol is lighted when the Infuser is plugged into the mains. The presence of the mains supply is constantly monitored by CPU through the A/D converter. If ac power is disrupted and the Infuser is on or in the Memory-Save mode, the Infuser will switch to the battery system and battery indicator will be lit.

#### **4.2.8 A/D Converter**

The A/D converter at U19 on the CPU/Display PWA with R10 and U18A is used to ensure the integrity of the LED display. It continually monitors the current drain and voltage of each individual segment. If any segment is open or shorted, U19 will detect this state and will stop the Infuser by means of a CPU-generated command. An appropriate malfunction message will be displayed at the same time.

#### **4.2.9 Motor And Drivers**

The motor mechanism, which drives the syringe by means of a lead screw, is a small, four-phase stepper with an integral 50-1 reduction gear train. The four phase motor drive signals are generated by the CPU and sent to the motor through U7 (the PPI) and U17, which drive Q6, Q7, Q8, Q9, located on the Power Supply PWA. U17 gates the motor drive signals with the "MALF" signal. This redundant safety circuit ensures that the motor stops if a malfunction occurs. U15, U16, and associated circuitry monitor the motor by comparing the phase relationship between the input and the output of the motor drivers. This circuit also detects open or shorted motor drivers, motor coils, or wiring. If a problem occurs, the "MOTBAD" signal to the CPU will stop the Infuser, and MALFUNCTION 3B will be displayed.

#### **4.2.10 Motor Rotation Sensor**

A secondary shaft of the motor gear-train assembly has the end flattened such that as it turns past a light emitting diode, it alternately closes off the light's path to the sensor. The output of this sensor becomes a signal called "SHAFT", which is monitored by the CPU through U14D and U8 on the Power Supply PWA. If the CPU does not detect a "SHAFT" signal for every 2700 motor steps, it will stop the Infuser and display MALFUNCTION 3A.

#### 4.2.11 Pressure Measuring System

Occlusion pressure is sensed by a micro-switch and adjustable bias spring assembly mounted atop the lead-screw mechanism of the syringe drive. In the event of an occlusion, the delivery set pressure build-up will cause the lead screw to move up against the bias spring and trip the micro-switch. When this occurs, an occlusion signal is sent to the CPU through U8 on the Power Supply PWA. Occlusion pressure is normally adjusted from 70 to 140 kPa (10 to 20 psi) with a nominal value of 119 kPa (17 psi).

#### 4.2.12 Alarms

The LifeCare® 4200 PCA Infuser alerts the user to an abnormal condition with an audible alarm. When a touchswitch control function is activated, a short beep or a flutter is emitted. Infusion is prohibited during all alarm conditions unless otherwise indicated.

Q3, on the Power Supply PWA, drives the AUDIBLE line from the CPU/Display PWA. The AUDIBLE signal can be activated by AUDIBLE from the CPU or MALF (malfunction) line from the watchdog circuit. When the AUDIBLE ADJUST switch is set to one of the three positions (the switch is on the back panel of the Infuser case), the piezoelectric alarm will be driven by one of three different combinations of resistors R15, R16, and RN5-1, 2. Three audible volume levels are supported. AUDHI also appears at the test port (J9) at pin 9.

Four different audio signals are generated by the Infuser. The flutter sound indicates an unacceptable touchswitch keypress. The single short sound indicates an acceptable touchswitch keypress. A continuous sound indicates a MALFUNCTION. Repeated Morse code "AA" ("short-long, short-long") signal indicates an alarm condition. The current display message is saved, and when the alarm condition is cleared, the message is redisplayed.

#### 4.2.13 Messages and Alarms

The LifeCare® 4200 PCA Infuser is programmed to display messages or alarms for a number of defined operating conditions. These messages and alarms are described below.

Table 4-1. Status Message Definitions

MESSAGE	DEFINITION
DOOR LOCKED	Displayed for 30 seconds when security door is closed and locked.
PATIENT LOCKOUT	Displayed after a successful patient-initiated dose delivery. The message remains until the lockout interval elapses. This message appears only when the security door is locked in the PCA or PCA+CONTINUOUS mode.
4-HR LIM REACHED	Displayed if a 4-hour limit has been selected and reached with security door locked.
***	Indicates that patient can initiate a dose in PCA or PCA+CONTINUOUS mode.
PCA	Displayed when Infuser is in PCA mode.
CONTINUOUS	Displayed when Infuser is in CONTINUOUS mode.
PCA+CONTINUOUS	Displayed when Infuser is delivering a PCA DOSE in addition to a continuous delivery in the PCA+CONTINUOUS mode.

The Infuser features an alarm system that warns the user of a problem and helps identify the cause. The alarm actions are:

- A flashing message appears on the display with all alarms (see Table 4-2).
- A repetitive audible tone sounds with all alarms except MALFUNCTION, which is a continuous tone. The audible tone is adjustable to low, medium, or high sound levels by means of the AUDIBLE ALARM switch located on the rear panel of the Infuser.
- The Infuser stops delivering when these alarms occur: CHECK BARREL, CHECK PLUNGER, CHECK SYRINGE, EMPTY SYRINGE, OCCLUSION, and MALFUNCTION.

#### 4.2.14 Silencing and Clearing Alarms

To silence any listed alarm, press **SILENCE/NO** and follow the displayed prompts.

The alarms are listed and explained in Table 4-2 along with instructions for clearing them.

Table 4-2. Infusion Alarm/Action Table

MESSAGE	MUTING PERIOD	POSSIBLE CAUSE	ACTION
CHECK BARREL (Audible delay 30 seconds)	None	Barrel is improperly installed or missing.	Properly insert the barrel in the barrel retainer.
CHECK PLUNGER (Audible delay 30 seconds)	None	Plunger improperly installed or missing.	Properly insert plunger in the driver/retainer assembly.
CHECK SYRINGE (Audible delay 30 seconds)	None	Syringe (barrel and plunger) improperly installed or missing.	Properly insert barrel and plunger in their proper retainers.
LOW SYRINGE	Indefinitely	1 to 3 mL of solution remaining the in the syringe.	Press <b>SILENCE/NO</b> to clear the alarm. This is a reminder for low amount of fluid.
EMPTY SYRINGE	15 minutes	The syringe is empty (0 to 1 mL left).	Silence EMPTY SYRINGE alarm by pressing the <b>SILENCE/NO</b> touchswitch. Unlock and open security door and turn Infuser off. Prepare barrel/plunger. Replace plunger and complete set-up.
CHECK SETTINGS	1 minute	The security door is closed and locked before set-up is complete.	Open the door and make sure that all settings are proper and entered.
CHECK 4-HOUR LIMIT	1 minute	The security door is closed and locked and 4-hour dose limit is set less than PCA dose.	Make sure PCA dose is less than 4-hour dose limit.
DOOR OPEN	2 minutes	The security door has been left open for more than 2 minutes without touchswitch activity.	Close and lock security door if all prescription parameters are entered or press <b>SILENCE/NO</b> to clear the alarm.

Table 4-2. Infusion Alarm/Action Table (Continued)

MESSAGE	MUTING PERIOD	POSSIBLE CAUSE	ACTION
OCCLUSION	1 minute	Kinked or occluded tubing, occluded venipuncture device, or closed slide clamp.	Close slide clamp. Open security door, if closed. Relieve back-pressure by squeezing and releasing the cradle release handles. Identify the cause of occlusion and correct it.
INFUSER IN RESET*	5 minutes	Operator pressed <b>RESET/START</b> touchswitch when security door was locked (in CONTINUOUS or PCA+CONTINUOUS mode) and delivery was in process.	Press the <b>RESET/START</b> touchswitch to resume delivery.
LOW BATTERY (Battery symbol will flash)	10 minutes (for two times; cannot be silenced after two times)	Battery is near discharge level; approximately 30 minutes of battery life remaining.**	Connect line cord to a mains supply or complete infusion in 30 minutes.
MALFUNCTION XX	None	Electronic circuit and/or software failure.	Note MALFUNCTION (XX code) displayed. Press <b>OFF/RECHG</b> touchswitch to silence alarm and turn Infuser off. Remove Infuser from service and refer it to qualified service personnel.

\* NOTE: INFUSER IN RESET message also appears after an alarm condition has been cleared. Press **RESET/START** to resume delivery.

\*\* NOTE: Infuser will shut down at the end of 30 minutes.

#### 4.2.15 Power Supplies

Infuser power is obtained from either an 8 Vdc 2.5 amp-hour battery pack, or the mains supply. The Power Supply PWA card develops four independent power supplies from this source.

The ac is supplied to the Infuser through a transformer primary. The secondary produces 14.2 Vac under no-load conditions. This voltage is supplied through J3, which also includes the battery primary. The ac inputs to the diode rectifier bridge CR14 produce the V+ unregulated voltage, filtered by C15.

##### BATTERY CHARGER:

Voltage reference U18, amplifier U12A, Q2, Q4, and associated circuitry provide a constant voltage power supply with current limiting of 1 A to charge the battery pack. This supply is active only when the Infuser is plugged into an appropriate ac outlet. The current limiting is connected in such a way that only excess current above that required to operate the Infuser is used to charge the battery. For example, at a typical Infuser operating current of 0.5 A, remaining 0.5 A would be available to charge the battery. If the Infuser is completely off, then the full 1 A is available to charge the battery. When the battery is fully charged, a trickle charging path is provided by R20 and CR6.

##### SAFETY SUPPLY:

U5 and U6 are an extremely low current 5 Vdc supply used to power the ON/OFF LATCH, the ON switch, and the syringe detector circuits. This supply is active at all times if ac or battery power is available.

##### LOGIC SUPPLY:

U9 is a self-contained 5 Vdc regulator used to power all of the remaining electronic circuits. It has on-board current limiting and thermal protection.

##### MOTOR SUPPLY:

U10 is a 5 Vdc regulator of the same type as U9, and provides power to the syringe drive stepping motor only.

Q1 is controlled by the ON/OFF LATCH through Q5 and is used to connect or disconnect unregulated voltage to the inputs of the logic supply, motor supply, and battery monitor.

#### 4.2.16 Watchdog Circuit

U15, U16A, U16B, and associated circuitry located on the CPU/Display PWA are connected to form a rate window comparator and latch. A pulse train with pulses 37.5 ms apart is output by the CPU on the line labeled "ACTIVITY". If the "ACTIVITY" pulse rate ranges beyond the predetermined

window, U15 will detect the variation and set the malfunction latch active. The watchdog circuit is tested for proper operation during the cold-start sequence when the CPU deliberately changes the activity line pulse rate enough to set the malfunction latch active. Then the CPU resets the malfunction latch if the test is successful.

#### 4.2.17 Battery Monitor Circuits

The battery monitoring circuits monitor the V+ unregulated voltage when Q1 is switched on. V+UN is directly related to battery voltage when the Infuser is not connected to ac power. U3A, U3B, reference U4, and associated circuitry form a two-level voltage comparator. U3B will send a low battery signal ("LOBAT") to the CPU through the PPI whenever the battery voltage falls below  $7.65 \pm 0.13$  Vdc. U3A will send a discharged battery signal ("DISBAT") whenever the battery voltage falls below  $7.13 \pm 0.13$  Vdc.

Under storage conditions, battery drain in the Infuser off state does not exceed 200  $\mu$ A. After the battery has discharged to the normal operating limit, it can be recharged to at least 90% of rated capacity within 16 hours when plugged into 230 Vac power.

**CAUTION: Operating the Infuser with the battery removed is not recommended, because in the event of mains supply failure, the unit cannot continue operating and all stored dose information will be lost.**

### 4.3 POWER OFF MODES

The LifeCare® 4200 PCA Infuser power down sequence is under microprocessor control.

When the OFF/RECHG touchswitch is depressed, the LCD and LED displays are blanked and all the controls except the ON switch and barrel and plunger sensors are disabled. The Infuser will remain in this mode, maintaining dose and set-up information for 1 hour. After 1 hour has elapsed, the output of the ON/OFF LATCH goes to a low state, turning Q5 and Q1 off, disconnecting the power to the 5 V regulators. The CPU will then shut down most of the electronics, leaving the ON switch, the barrel sensor, and the plunger sensor active as long as battery or ac power are available.

This power down sequence also occurs in the event of a discharged battery.

#### POWER DOWN:

During power down, the following events occur:

- The motor (if operating) is stopped.
- The LED display is blanked.
- The LCD display is blanked.

- Touchswitches become inactive except the ON and the OFF/RECHG touchswitches.
- The ON/OFF LATCH remains active.
- If OFF/RECHG touchswitch is pressed momentarily (grid lines present), the Infuser enters Memory-Save mode.
- If OFF/RECHG touchswitch is pressed for approximately 4 seconds (grid lines disappear), the Infuser enters Storage mode.

#### **MEMORY-SAVE MODE:**

In this mode, the processor and associated circuitry stay active so that all dose history and set-up information are retained for a period of 1 hour.

After an hour has elapsed, the Infuser enters into Storage mode.

#### **STORAGE MODE:**

In this mode, all electronics are turned off except the ON touchswitch, the barrel switch, the plunger switch, the ON/OFF LATCH, the real-time clock, and external RAM.

All set-up parameters and dose history are lost and the real-time clock continues to run. Patient switch tone selection is retained.

**NOTE:** All parameter settings and delivery history are lost in the event of a complete shut-down or disconnection of the sealed lead-acid battery and ac power.

## **4.4 POWER UP MODES**

The PCA Infuser can be turned on by activating the ON touchswitch, the barrel switch, or the plunger switch. These switches will initiate one of the following modes:

#### **COLD-START MODE:**

Pressing the ON touchswitch, the barrel switch, or the plunger switch begins a cold-start sequence if the Infuser has been in Storage mode. The ON/OFF LATCH activates Q5 which, through Q1, applies V+UN voltage to the logic supply.

When the self-test has finished, the Infuser is ready for operation. This is announced by displaying the date-time on the LCD and sounding the Morse Code "AA" alarm once. The first set-up prompt is displayed on the LCD.

#### **WARM-START MODE:**

Pressing the ON touchswitch, the barrel switch, or the plunger switch begins a warm-start sequence if the Infuser has been in Memory-Save mode.

The LCD displays the self-test completed message.

The current time and date are momentarily displayed on the LCD, and then the first set-up prompt is displayed.

**SYRINGE INSERTION OR REMOVAL:**

Syringe insertion or removal will activate the barrel and plunger detection switches. This will initiate a cold-start or a warm-start sequence as discussed above.

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## 5.0 Maintenance and Checkout Procedures

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## 5.0 MAINTENANCE AND CHECKOUT PROCEDURES

This section of the manual contains the maintenance and checkout instructions for the LifeCare® 4200 PCA Infuser.

The Infuser requires periodic checkout and preventive maintenance for proper operation. Infuser checkout is accomplished without the aid of additional test instruments. Cleaning and preventive maintenance procedures require common supplies found in most hospitals.

### 5.1 PREVENTIVE MAINTENANCE

An organized maintenance program for the Infuser is important for patient and staff safety. This scheduled program will assure that the Infuser operates properly.

Infuser maintenance requires:

- A routine schedule of cleaning after each use, and
- Minor adjustments as required.

**CAUTION: Immersing the Infuser in water will result in an electrical shock. This will also damage the pump.**

As a minimum requirement, clean the Infuser after each use. If the Infuser is used for long periods, establish a cleaning schedule during use; for example, clean the Infuser each time an empty syringe is replaced. In addition, clean the Infuser after any scheduled maintenance check, repair, or adjustment.

Use no abrasive cleaners on the Infuser housing or security door.

Sterilizing with heat, steam, or radiation will cause the Infuser to malfunction.

Clean the Infuser as follows:

- First, turn the Infuser off and disconnect the power cable.
- Clean the Infuser housing with a damp cloth, using a mild soapy water solution.
- Clean the pendant control cable with a cloth and a mild soapy water solution.

## 5.2 FIELD CHECKOUT PROCEDURES

### 5.2.1 The Test Port

Connector J11 is a D15 connector located behind a rear-panel access cover. The important signals and test points are available at this connector to help troubleshoot the Infuser for a quick checkup. The pin assignments are as follows:

Table 5-1. D15 Connector Pin Assignments

PIN NUMBER	FUNCTION
1	+5VDC
9	BAT+
2	VMOT
10	<u>PRINT</u>
3	<u>ONSW</u>
12	<u>OFFSW</u>
5	AUDHI
13	<u>PATIENTSW</u>
6	<u>DOORSW</u>
14	<u>SYRINGEMPTYSW</u>
7	<u>SYRINGELOSW</u>
15	<u>PRESSURES</u> W
11	<u>VIALSW</u>
4	<u>INJECTORSW</u>
8	GND

The following steps will provide access to the test port:

**CAUTION: DO NOT REMOVE THE COVER  
WITHOUT FIRST DISCONNECTING THE MAINS  
SUPPLY.**

1. Disconnect Infuser from mains supply.
2. Remove the phillips-head screw that secures the lower rear panel.
3. The test port requires a 15-pin D connector for hook up to testing device. (See Table 5-1 for pin call-outs).

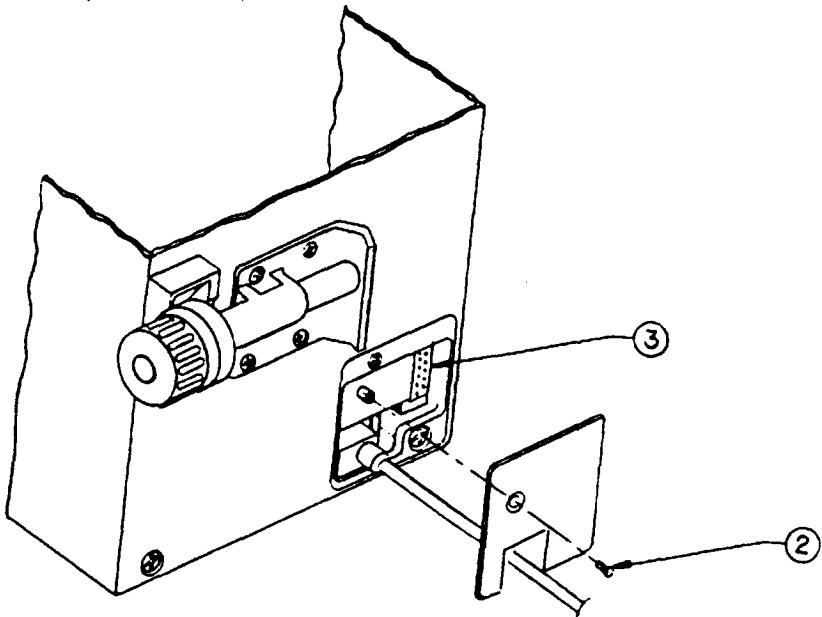


Figure 5-1. Locating the Test Port

### 5.2.2 Service Test Mode

Service Test mode enables the technician to set the operation of the patient pendant tone for PCA demands and troubleshooting of the basic functions of the LifeCare® 4200 PCA Infuser. This mode displays test results and next test sequence on the front panel LCD while the test is progressing. Any data in RAM memory will be lost during these tests. The Service Test mode is not provided as an acceptance test for units that have been repaired.

The Service Test mode is entered using the following procedure:

1. Connect the Infuser to a properly earthed mains supply, and check that the front-panel mains indicator lights up.
2. The Infuser must be in the completely shut off Storage mode. To accomplish this, open the security door and press and hold the RECHG key for 6 seconds.
3. Press and hold the ENTER key followed by the ON key. Hold both keys simultaneously for 3 seconds.
4. The LCD displays "INT RAM TEST" until the "SERVICE TEST" appears. Also appearing are the current software version and the total elapsed Infuser "on" time (in days) since the infuser was placed into service.
5. Tests are self-prompting, giving the options of repeating the test again or going on to the next test.

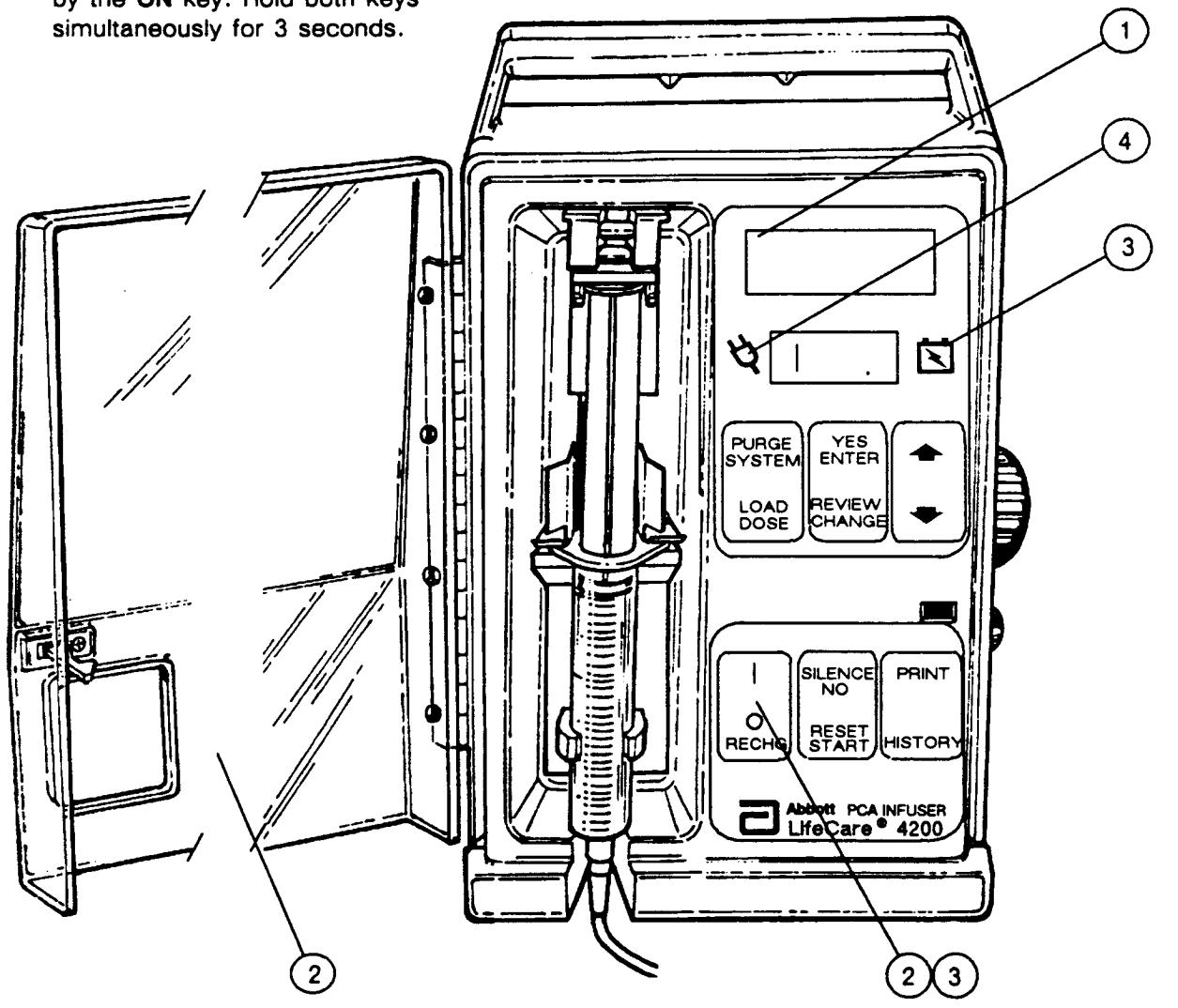


Figure 5-2. To Enter the Service Test Mode

**WARNING: NO PATIENT SHOULD BE CONNECTED TO THE PUMP DURING TESTING.**

The Service Test mode requires active service person input and constant intervention to perform the various tests. These tests are not to be used as a verification of adequacy of service. Service must be verified with approved procedures by a technician qualified by Abbott. These tests may be used by a technician for trouble identification. If any discrepancy is observed in the performance of these tests, the test should be repeated. If a test fails, remove the Infuser from service and send it to the Abbott repair facility listed in Section 6.0.

Following is a list of tests included in Service Test mode. Each test is self-prompting and displays directions on the LCD.

**Software Version:**

The Infuser displays the current software version to help identify the revision level of the program in EPROM.

**Elapsed Days:**

This reflects the actual number of days the Infuser has been in operation.

**Int RAM Test:**

A test is performed on the internal RAM to ascertain the validity of the data.

**Ext RAM ADRS Test:**

A test is performed to determine the integrity of the address lines.

**Ext RAM Cell Test:**

A test is performed on the external RAM to ascertain the validity of the data.

**CPU Test:**

A test is performed to assure that the CPU executes an instruction as expected.

**ROM Test:**

A checksum is calculated and compared with a prestored and precalculated checksum. This determines the validity of the EPROM data.

**RTC Test:**

The real-time clock is tested to verify that the clock information is updated periodically.

**LED Visual Test:**

A pattern of "1"s through "9"s is displayed on the LED for the user to see and verify.

**LCD Test:**

A non-visible pattern is written to the LCD RAM and compared with a stored pattern to assure validity of the LCD RAM data.

**Key Pad Test:**

A stuck key test is performed to see if any of the keys are

permanently shorted. The test technician is prompted to press individual keys to see if they are operational. The patient pendant is also tested.

**Indicator Test:**

The "Battery" and "Mains" symbols are turned on and off during this test.

**Alarm Test:**

An audible sound test associated with the three levels of audio alarm is tested for proper operation. The test technician should judge the failure or passing of this test.

**Motor Rotation Test:**

In this test, the motor is rotated for one full turn to see that the shaft sensor sends the proper signal.

**Door Test:**

This test verifies that the Infuser recognizes the door condition.

**Syringe Test:**

This test verifies that the Infuser detects the presence and positioning of the barrel and plunger in the syringe driver mechanism.

**Low/Empty Syringe Test:**

This test verifies that the Infuser properly detects Low Syringe ( $2 \text{ mL} \pm 1 \text{ mL}$ ) and Empty Syringe positions.

**Patient Pendant Tone Selection:**

The test technician can select the option of setting the audible tone for successful PCA Dose only, or for each time the patient pendant is depressed. The factory setting is always for successful PCA dose only, but the user may select the other option.

### **5.2.3 Safety Tests**

Using an approved safety analyzer and hi-pot tester, perform the following tests:

- Plug mains connector into the safety analyzer. Leakage should not exceed  $25 \mu\text{A}$ .
- Measure ground lug of mains connector and pole clamp assembly mounting screws. Resistance should not exceed 0.1 ohms.
- Perform high voltage dielectric strength test per EEC 601-1, paragraph 20.4. Test for 1 second at  $1900 \text{ V}\sim$ .

If any discrepancies are observed in the safety tests, remove the Infuser from service and send it to the Abbott repair facility listed in Section 6.0.

## 6.0 Field Service and Repair

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## 6.0 FIELD SERVICE AND REPAIR

For technical assistance and information, contact:

To report a pump failure, or to order service parts, pump manuals, or accessories, contact your Abbott Sales Representative at the above address.

If the unit is under warranty or contract, a replacement unit will be sent.

If the unit is out of warranty, a replacement unit can be exchanged or repaired for a nominal cost.

Please send all returns, freight prepaid, to the address below:

Ask your Abbott Sales Representative for information on the Abbott Extended Warranty for the LifeCare 4200 PCA Infuser.

### 6.1 TROUBLESHOOTING

The following troubleshooting guide is structured according to the various subsystems of the PCA Infuser. Operating problems are listed with their probable causes and with corrective actions that should be taken by the operator or by the hospital technician depending on the nature of the problem.

#### 6.1.1 Preliminary Inspection

Perform a preliminary inspection of the unit before opening the case. Ascertaining damaged components visually will help target areas that need attention.

The following steps are a suggested checklist:

- Inspect the front panel of the Infuser for damage.
- Check that the security door locks properly.
- Using the instructions found in Section 5.2.2, remove the retainer plate from the power cord and test port. This will allow access to the fuses.

- Check both mains fuses, F1 and F2, located in the transformer assembly. Replacing these fuses may correct any faults.
- After disassembling the front case from the rear case (described in Section 6.2), inspect all cable connections for proper insertion.
- Mechanically inspect inside the Infuser for broken material or loose objects. This includes debris, metal, or plastic.
- Inspect the micro switches of the delivery system for damage or maladjustment.
- Run all the tests discussed in Section 5.3.

### **6.1.2 Troubleshooting Guide**

The following troubleshooting guide is structured according to the various subsystems of the PCA Infuser. Operating problems are listed with their probable causes and with corrective actions that should be taken by the operator or by the hospital technician depending on the nature of the problem.

**NOTE:** All schematics and assembly drawings for the LifeCare 4200 PCA Infuser are found in Section 10.0. In addition, a complete parts list for the unit is provided at the end of that section. When it becomes necessary to order parts, refer to Section 6.0 above.

Table 6-1. Troubleshooting Guide

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
<b>BATTERY OPERATION:</b> No battery operation	Discharged battery.  Defective battery.	Connect pump to mains power for at least 16 hours.  Prior to changing battery, check voltage at pin 9 of J11 (Test Port) with pump disconnected from mains. If battery voltage is less than 7.2 Vdc, replace the battery.  Whenever a battery is replaced, the battery charging circuit should be checked as follows:  Substitute a 470 ohm resistor in parallel with a 100 $\mu$ F capacitor in place of the battery. Plug the pump into mains power. The voltage across the 470 ohm resistor should measure 9.40 Vdc $\pm$ 0.1. If not, replace the Power Supply PWA.
Short operating time to LOW BATT alarm	Battery not fully charged or defective.	Charge battery for at least 16 hours. Operate pump at a continuous rate of 20 mg/hr with the battery. If time to LOW BATT alarm is less than 4 hours, replace battery pack and/or check battery charger as above.
Short operating time from LOW BATT alarm to shutdown	Battery not fully charged or defective.	Charge battery for at least 16 hours. Operate pump at a continuous rate of 20 mg/hr. If time to LOW BATT alarm shutdown is less than 30 minutes, replace battery pack and/or check battery charger as above.
<b>MAINS OPERATION:</b> Operation on battery when connected to mains (BATT legend is on)	Blown mains fuse. <b>CAUTION: DISCONNECT THE UNIT FROM POWER LINE BEFORE REPLACING FUSE.</b>  Defective primary circuit component.	If fuse is blown, replace fuse and measure ac current in Set-Up mode. If current exceeds 200 mA RMS, replace Power Supply PWA.  Ac voltage between J3 pins 2 and 3 should measure between 11 and 17 Vac. If not, check and replace line cord P3 transformer or fuse holder as necessary.
Does not operate on mains or battery	Defective Power Supply PWA.	Replace Power Supply PWA.

Table 6-1. Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
<b>AUDIBLE ALARM:</b> No audible alarm	Defective piezo alarm.  Defective Power Supply PWA audio alarm circuits.	Replace piezo alarm.  Replace Power Supply PWA, force pump into an alarm mode, check audio alarm circuit Q3.
Unable to change audible alarm volume	Defective audible alarm switch.	Replace audible alarm switch.
<b>OCCLUSION ALARM:</b> Occlusion has occurred	Closed clamp on IV set.  Other restrictions, pinched tubing or clogged filter.  Maladjusted or defective pressure measuring system.	Open clamp.  Remove restriction.  Return Infuser to factory.
<b>MALFUNCTION CODE 1A THROUGH 4R:</b> MALFUNCTION 1A	Watchdog circuit has failed during power up because the malfunction line went low and could not return to normal.	Replace CPU/Display PWA.  Check watchdog circuits.  Replace U5, U16, or U11.
MALFUNCTION 1B	Watchdog failed on power up, because the MALF line stayed low and could not reset.	Replace CPU/Display PWA.  Check watchdog circuits.  Replace U5, U16, or U11.
MALFUNCTION 1C	Watchdog failed on power up because the MALF line did not go low soon enough.	Replace CPU/Display PWA.  Check watchdog circuits.  Replace U5, U16, or U11.
MALFUNCTION 1D	Power up after the first two tests the MALF line timed out too soon.	Replace CPU/Display PWA.  Check watchdog circuits.  Replace U5, U16, and U11.

Table 6-1. Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MALFUNCTION 1E	The watchdog circuit failed during real-time operation.	Replace CPU/Display PWA. Check watchdog circuits. Replace U5, U16, or U11.
MALFUNCTION 2A	Power-up diagnostic failed.	Replace CPU/Display PWA. Replace CPU (U11) or EPROM (U22).
MALFUNCTION 2B	Checksum failed.	Replace EPROM (U22).
MALFUNCTION 3A	Motor failed to rotate.	Replace Power Supply PWA. Check watchdog circuits U7, U17, Q6 through Q9, or the shaft sensor.
MALFUNCTION 3B	Motor bad signal.	Replace Power Supply PWA. Replace drive motor. Check motor drive and motor monitor circuits, Q6 through Q9, U17, U15, and U16.
MALFUNCTION 4A	LCD time-out error.	Replace CPU/Display PWA. Replace LCD module.
MALFUNCTION 4B	LCD data read-back error.	Replace CPU/Display PWA. Replace LCD module.
MALFUNCTION 4C	External RAM read-back error.	Replace CPU/Display PWA. Replace RAM U21.
MALFUNCTION 4D	ROM error, checksum failed.	Replace CPU/Display PWA.
MALFUNCTION 4E	Not used.	Replace EPROM U22.

Table 6-1. Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MALFUNCTION 4F	LED segment is bad.	Replace CPU/Display PWA.  Check LED, LED driver and LED checking circuits U2, U3, U8, U9, U14, or U18.
MALFUNCTION 4G	Real-time clock stopped.	Replace CPU/Display PWA.  Replace U21 - DS1216.
MALFUNCTION 4H	Keyboard error, touchswitch stuck.	Replace touchswitch panel.  Replace CPU/Display PWA.  Check touchswitch circuits, U4.
MALFUNCTION 4I	Low battery.	Connect Infuser to ac power.  Replace battery pack.  Replace Power Supply PWA.  Check battery charger circuits, U12 and Q2.
MALFUNCTION 4J	Software error.	Replace CPU/Display PWA.  Replace EPROM, U22.
MALFUNCTION 4K	Not used.	
MALFUNCTION 4L	Not used.	
MALFUNCTION 4M	Not used.	
MALFUNCTION 4N	Redundant timer T1 error.	Replace CPU/Display PWA.  Replace EPROM (U22) or CPU (U11).
MALFUNCTION 4O	Redundant timer T2 error.	Replace CPU/Display PWA.  Replace EPROM (U22) or CPU (U11).

Table 6-1. Troubleshooting Guide (Continued)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MALFUNCTION 4P	Program error.	Replace CPU/Display PWA. Replace EPROM (U22) or CPU (U11).
MALFUNCTION 4Q	Stack error.	Replace CPU/Display PWA. Replace EPROM (U22) or CPU (U11).
MALFUNCTION 4R	A/D error.	Replace CPU/Display PWA. Replace EPROM (U22) or CPU (U11). Replace A/D (U19).

## 6.2 DISASSEMBLY INSTRUCTIONS

### 6.2.1

#### Chassis Disassembly

**WARNING: DO NOT REMOVE THE FACE PLATE WITHOUT FIRST DISCONNECTING THE INFUSER FROM MAINS POWER.**

1. Disconnect Infuser from mains power.
2. Remove three (3) phillips-head screws from the back of the Infuser chassis.
3. To remove lower right-hand phillips-head screw, remove the phillips-head screw that secures the rear lower panel.
4. Carefully separate the face from the chassis so that connectors are not disconnected.
5. Ascertain which cable connects with which PWA before complete separation takes place.
6. Mark cables and connectors before removing PWA for test.

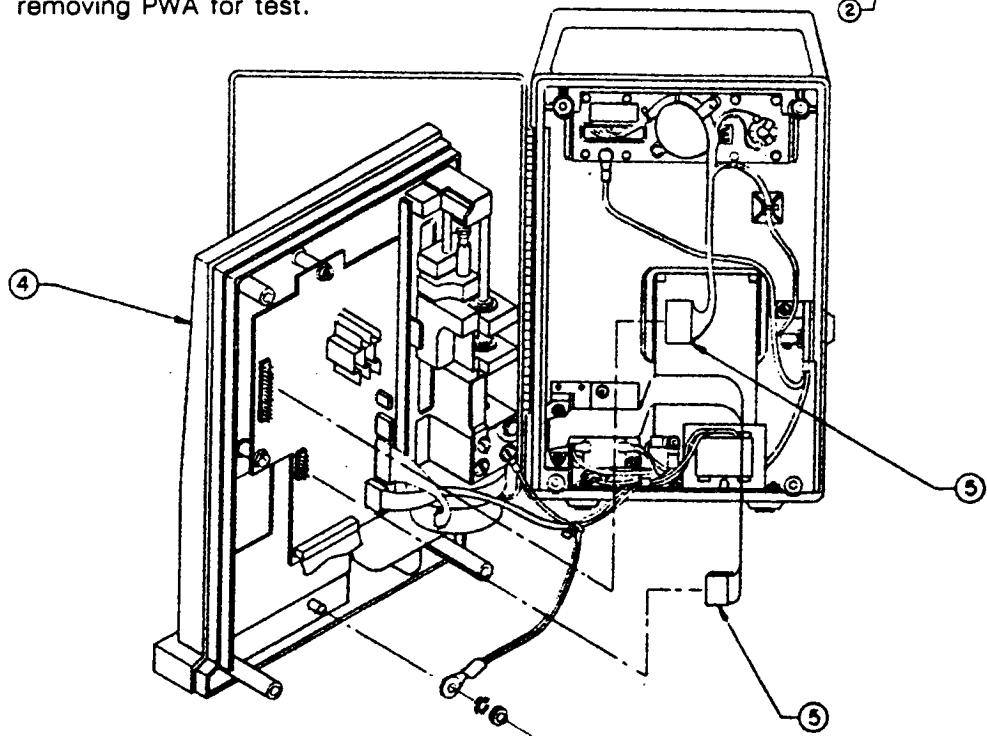
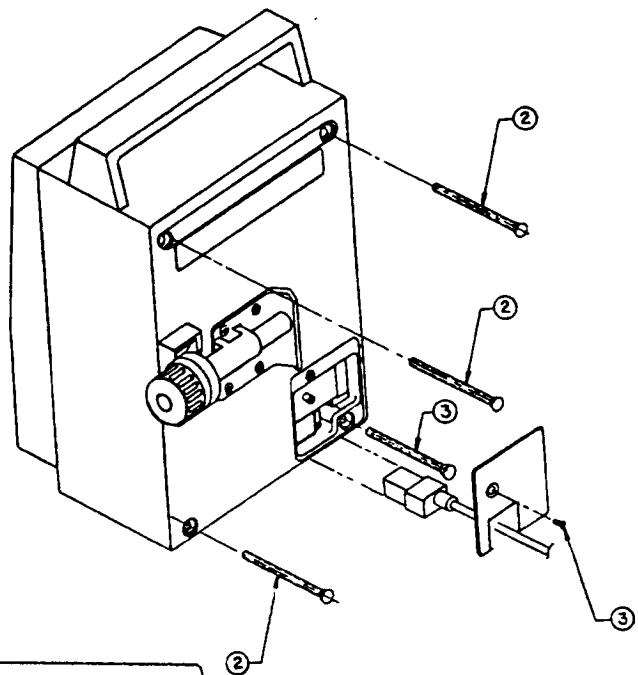


Figure 6-1. Chassis Disassembly

## 6.2.2 Reassembly Instructions

Reassembly is accomplished by reversing the disassembly procedures above. Ensure that the set screws, etc., are properly seated.

## 6.2.3 Service Test

After reassembly, the unit must be functionally tested to verify repair adequacy. Functional testing and repair should be performed by a service technician qualified by Abbott (see Section 9.0, Warranty).

## 6.2.4 Battery Charger Circuit

After reassembly, check battery charger circuit (see Table 6.1, Mains Operation).

## 6.2.5 Safety Test

After reassembly, test the unit for safety per safety tests, subsection 5.2.3.

## 6.3 BATTERY REPLACEMENT PROCEDURE

**CAUTION: Battery removal means loss of data and the complete shut-down of the pump.**

1. Locate battery cover plate on the bottom of the Infuser.
2. Place the Infuser on its face and remove the two screws.
3. Set the plate aside. Locate the red and black pair of wires.
4. Push the battery pack *into* the cavity and gently pull out the white connector which is attached to the red and black pair of wires.
5. With the white connector pulled out of the cavity, the battery pack can be removed.
6. Check battery charger circuit in accordance with Table 6.1, Mains Operation.

## 6.4 BATTERY MAINTENANCE

An 8 V, 2.5-Ah, sealed, lead-acid battery powers the pump in the event ac power is absent when the **MAIN CONTROL** switch is rotated to the **LOCK/ON** position. The battery normally provides approximately 6 hours operation at a delivery rate of 20 mg/hr. Operating time increases with lower rate settings. The battery provides 30 minutes of operation after a **LOW BATT** alarm.

Batteries have a float life of 5 years if used for emergency back-up and temporary portable operation. The Infuser should be connected to the mains supply at all other times. Batteries run 4 hours or less need 16 hours of recharging to be fully recharged.

If the Infuser is used frequently for portable operation over 4 hours, the float life is significantly reduced and batteries will

require more frequent replacement. If batteries run over 4 hours are recharged for 16 hours, they will need replacement after approximately 20 discharge/recharge cycles. They actually require 60 hours to be fully recharged and will last up to 150 cycles. However, as this is impractical in most cases, the 16-hour recharge period can be selected, with the trade-off of a shorter battery life.

## 7.0 Safety/Security Features

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## 7.0 SAFETY/SECURITY FEATURES

### 7.1 ELECTRONICS

The following checks are performed during the Infuser power up sequence:

- Self-checking software completely checks microprocessor registers and RAM.
- A checksum routine is performed to ensure the correct operation of the program storage EPROM.

The following electronic checks are performed continuously during operation of the LifeCare® 4200 PCA Infuser:

- All touchswitches (including touchswitches inaccessible through the locked security cover) are monitored by the microprocessor while the Infuser is in the Patient Control mode (where the security door is closed and locked). Any tampering with, or malfunction of, these controls is detected by the microprocessor.
- A separate hardware circuit continuously monitors the microprocessor execution speed, and is capable of detecting variations in the rate due to a processor or crystal malfunction.
- A dual redundant software algorithm is used to drive the syringe drive motor. This algorithm prevents over-delivery (or under-delivery) of drug.

**Note:** The above checks result in a MALFUNCTION ALARM when detected.

- A stepping motor (rather than a dc motor) is used to eliminate the possibility of a random motor drive component failure, which could cause the motor to run at erratic and uncontrollable speeds.

### 7.2 MECHANICAL FEATURES

Mechanical features include:

- The locking transparent security cover prevents tampering with drug syringe and controls.
- A Dual-Lock™ mechanism locks the Infuser to the IV pole when the security door is closed and locked.

- The PCA Infuser will only permit the use of the Becton-Dickinson syringe (List #9662) and specially designed Abbott PCA Infusion Set to prevent the inadvertent use of incorrect or inappropriate drugs or concentrations.
- The syringe driver mechanism incorporates sensor switches, which detect improper placement of the barrel and plunger.

## 8.0 User Qualification

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## 8.0 USER QUALIFICATION

The LifeCare® 4200 PCA Infuser is for use by licensed physicians or licensed, certified health care professionals who are trained in the use of the Infuser and the administration of medical fluids. Use of the Infuser by other than physicians or health care professionals should only be undertaken following proper instructions, training, and qualification of the user. Such use must be authorized in writing by the physician.

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## **9.0 Warranty**

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## 9.0 WARRANTY

The LifeCare® 4200 PCA Infuser has been carefully manufactured from high quality components. They are warranted to be free from defects in material and workmanship under normal use and service for a period of 1 year from the date of purchase. On return to Abbott, the Infuser will be repaired or replaced within the terms of this warranty.

The warranty on the replaceable battery is limited to 90 days under normal use and service.

Material returned to Abbott must be properly packaged and sent freight prepaid.

This warranty shall not apply if the Infuser has been repaired by anyone other than service personnel qualified by Abbott, or altered in any way which, in Abbott's judgment, affects its stability or reliability, or if the serial number has been altered, effaced, or removed.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES,  
EXPRESS OR IMPLIED.**

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## 10.0 Drawings and Parts List

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## 10.0 DRAWINGS AND COMPONENT PARTS LIST

### 10.1 SYMBOLS AND ABBREVIATIONS

This drawing section provides a convenient cross-reference for use with Section 4.0, Theory of Operation, and Section 6.1, Troubleshooting Guide. To facilitate ordering replacement or spare parts, each drawing is accompanied by a list of component parts, identified by part number, description, and reference designator. A list of recommended spare parts is also included below in Section 10.4.

**Letter symbols** used in the drawings and as reference designators in the parts list include:

U	=	Integrated circuit
Q	=	Transistor
CR	=	Diode
C	=	Capacitor
J	=	Connector (male)
P	=	Connector (female)
R	=	Resistor
F	=	Fuse
K	=	Relay
Y	=	Crystal

**Abbreviations** used in the parts lists include:

IC	=	Integrated circuit
LED	=	Light-emitting diode
MPU	=	Main processor unit
PWA	=	Printed-wiring assembly
PWB	=	Printed-wiring board
XFRM	=	Transformer

### 10.2 TITLE BLOCK

The standard **title block** on the lower right corner of the drawings contains the following reference information of importance to the reader.

**Title:** Identifies the board/sub-assembly by function.

**Drawing Number (XXX-XXXXX-XXX):**

- The first three digits identify the subject matter of the drawing, ie,

249	= schematic
810	= electrical sub-assembly/bill of material
830	= electrical sub-assembly
840	= mechanical sub-assembly
850	= mechanical final assembly

- The second five digits are the major product/part numeric designator.
- The "dash number" is a three-digit suffix located on the drawing just above the title block. It identifies a schematic or board/assembly as belonging to a particular product configuration or modification.
- The alpha designator is for production/control purposes and is not significant to the end-user.

## 10.3 ORDERING REPLACEMENT PARTS

Assembly-mounted components are found in the parts list following the part's assembly drawing. Order parts by contacting your Abbott Technical Service and Repair Center at the number listed below:

## 10.4 RECOMMENDED SPARE PARTS

DESCRIPTION	PART NUMBER
Battery Pack	642-76002-002
Pole Clamp Assembly	840-04080-006
Touchswitch Panel	812-04219-004
Power Supply PWA	810-04212-003
CPU/Display PWA	810-04213-003
Motor Assembly	830-04239-001
LCD Display (optional)	692-70260-001

Patient Switch Assembly 830-04241-004

( \$69.50 & 2-03-00 )

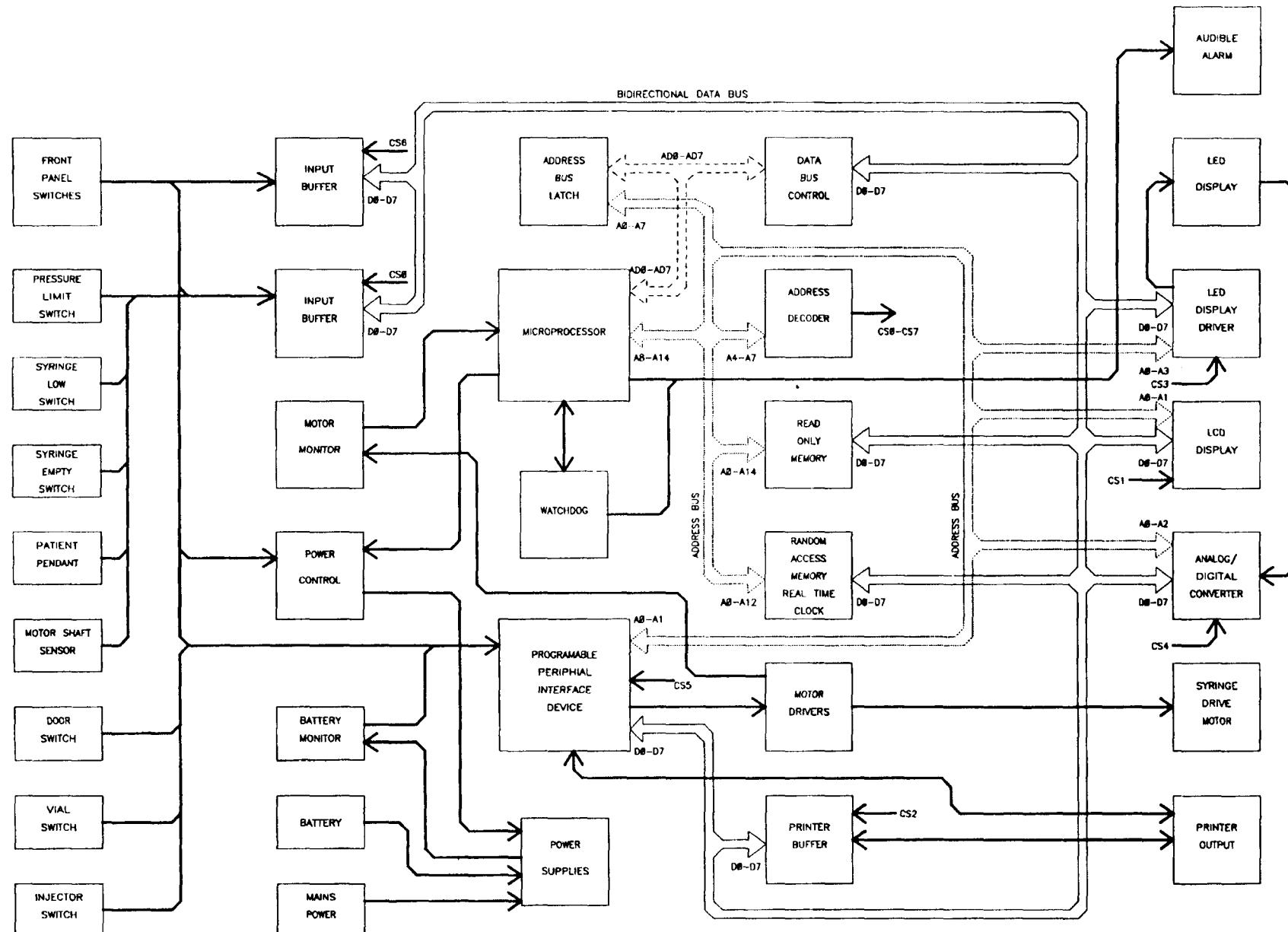
## 10.5 DRAWING LIST

Selected Engineering Drawings for the LifeCare® 4200 PCA Infuser Service Manual include:

**Table 10-1. Cross-index of Assembly Titles to Document Numbers**

DESCRIPTION	DRAWING	PARTS LIST
247-04250-001 Sheet 1 of 1, Block Diagram	Figure 10-1	Not Applicable
249-04250-001, Sheet 1 of 1, System Interconnect Schematic	Figure 10-2	Not Applicable
249-04212-005 Sheet 1 and 2 of 2, Power Supply Schematic 810-04212-006 Sheet 1 of 1, Power Supply Assembly	Figure 10-3 Figure 10-3-1	Not Applicable Table 10-2
249-04213-002 Sheet 1 of 1, CPU/Display Schematic 810-04213-008 Sheet 1 of 1, CPU/Display Assembly	Figure 10-4 Figure 10-4-1	Not Applicable Table 10-3
840-04332-001 Sheet 1 through 3 of 3, Rear Case Assembly	Figure 10-5	Table 10-4
840-04080-006 Sheet 1 of 1, Pole Clamp Assembly	Figure 10-6	Table 10-5
830-04221 Sheet 1 (-002) and 2 (-003) of 2, Control Panel Assembly	Figure 10-7	Table 10-6
830-04334-001 Sheet 1 and 2 of 2, Transformer/Receptacle Assembly	Figure 10-8	Table 10-7
830-04227-001 Sheet 1 of 1, LCD Display Assembly	Figure 10-9	Table 10-8
830-04320-003 Sheet 1 of 1, Electronics Assembly	Figure 10-10	Table 10-9
840-04313-004 Sheet 1 and 2 of 2, Front Case Assembly	Figure 10-11	Table 10-10
840-04350-002 Sheet 1 of 1, Slide Assembly	Figure 10-12	Table 10-11
830-04358-001, -002 Sheet 1 of 1, Transformer Assembly	Figure 10-13	Table 10-12

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- 001

**ABBOTT LABORATORIES**  
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## BLOCK DIAGRAM

DRAWING NO.

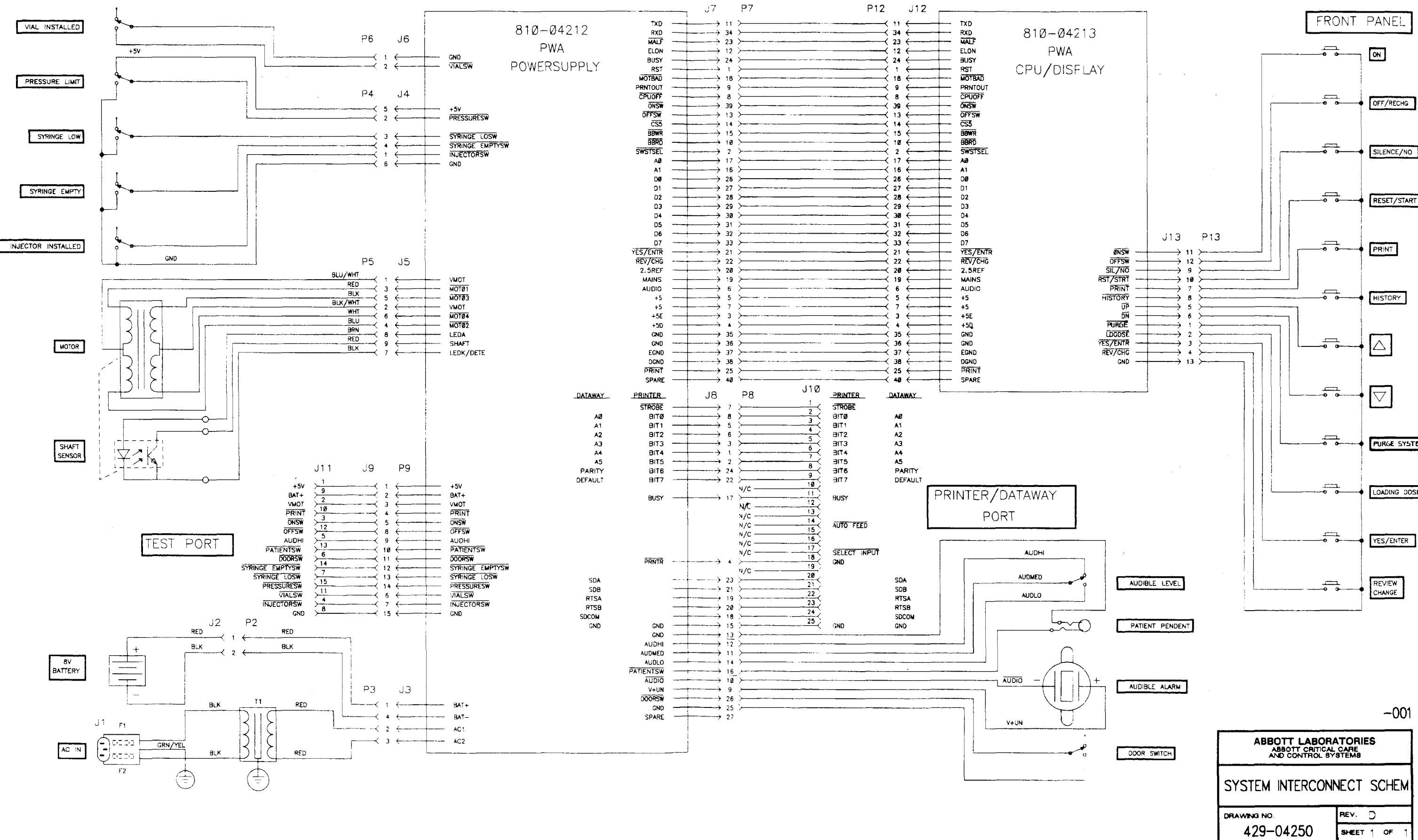
REV. A

SHEET 1 OF 1

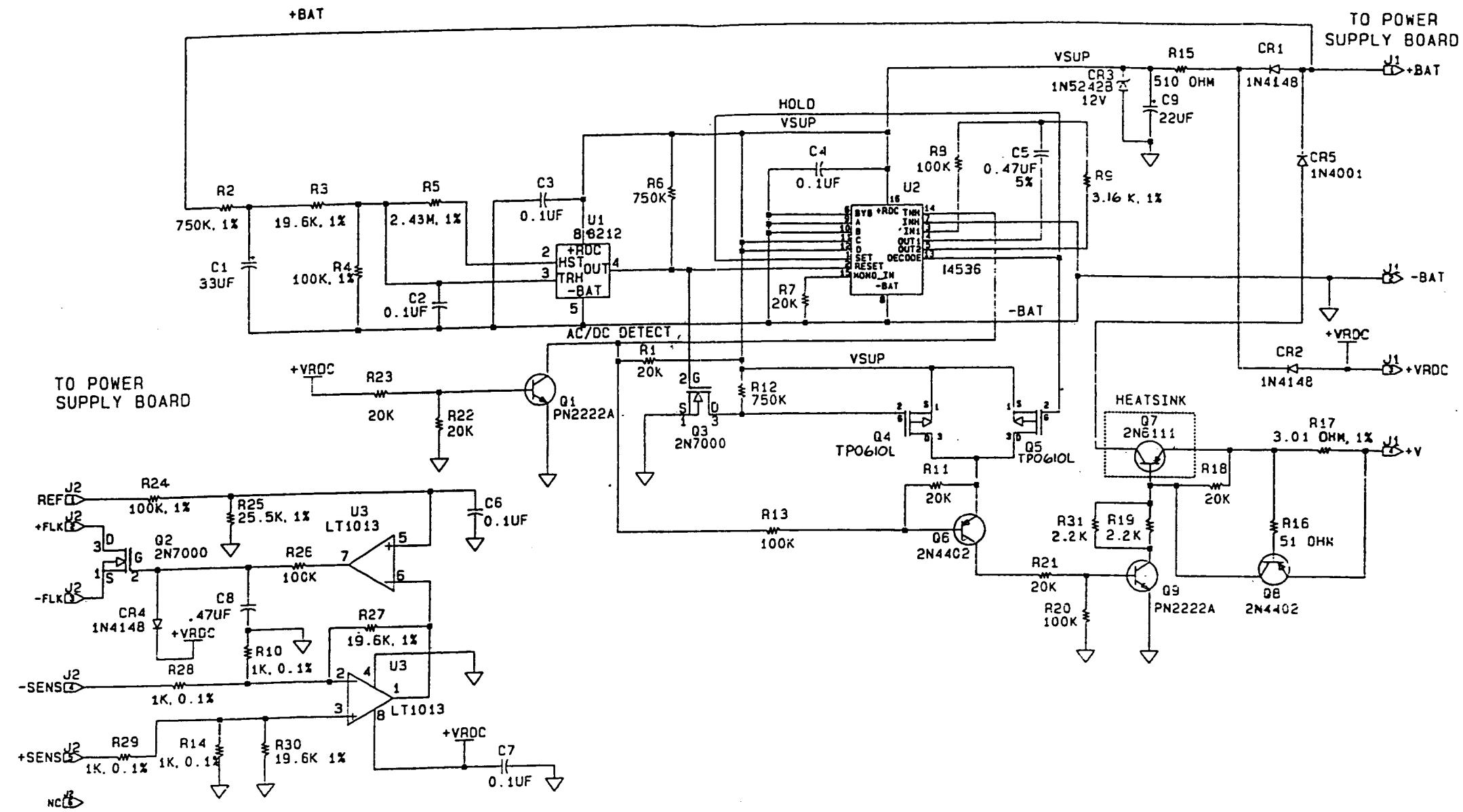
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Figure 10-2

## System Interconnect Schematic



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HOSPITAL PRODUCTS DIVISION-MY

Figure 9-8. Current Boost Charger Schematic, MDL 4/PCA

**DRAWING NO.** **REV. A**

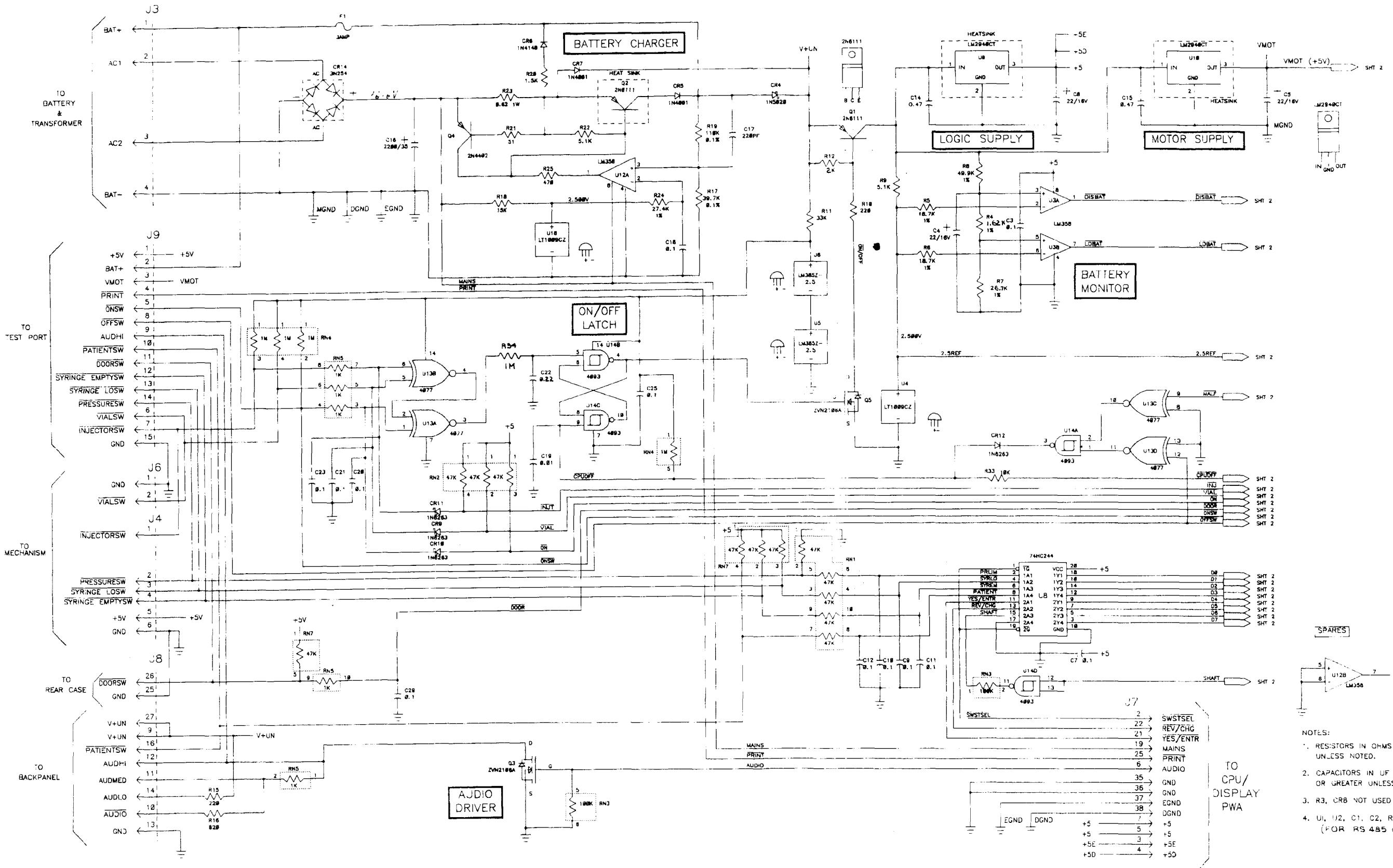
249-04469-002

SHEET 1 OF 1



Figure 10-3

## Power Supply Schematic

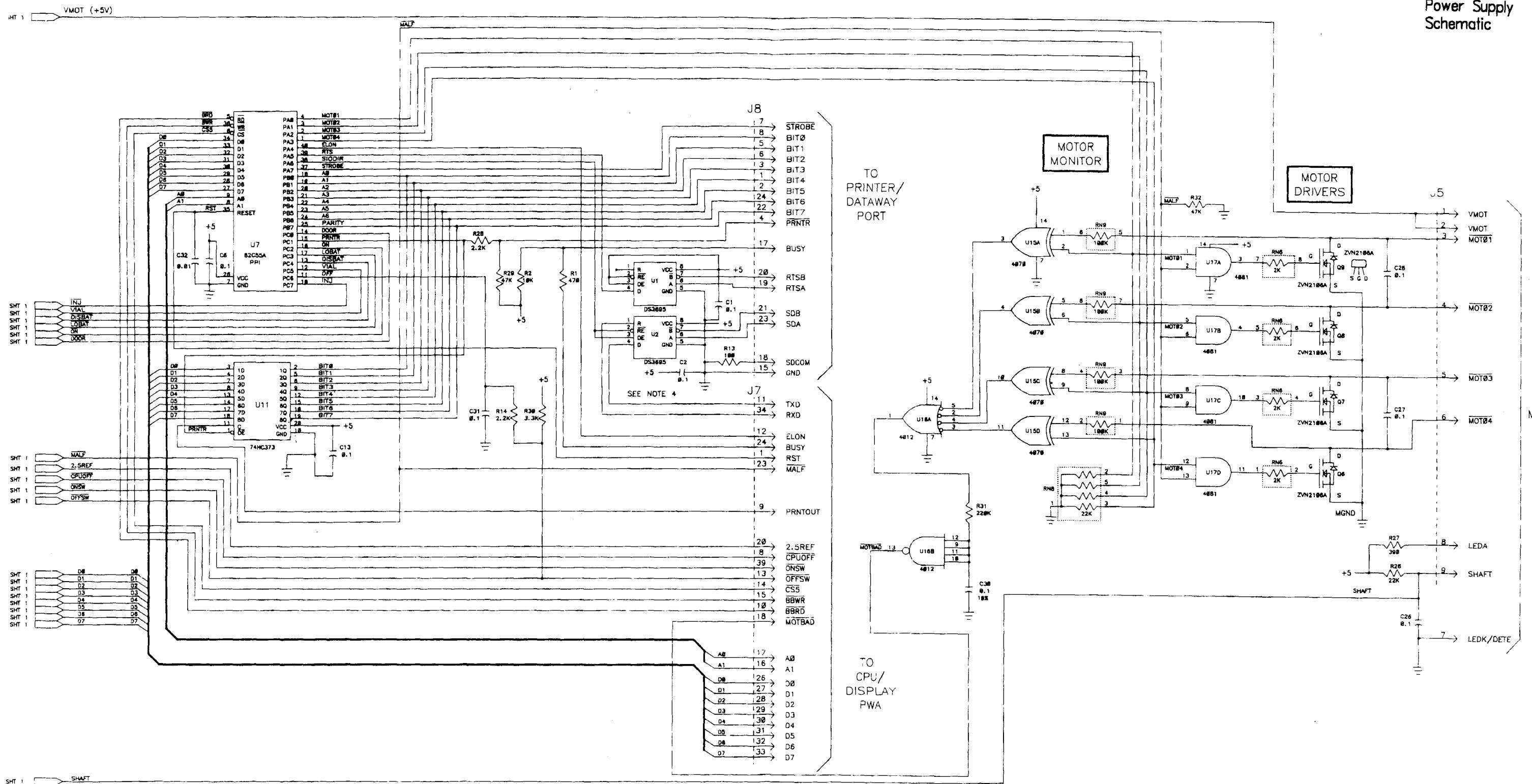


ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
POWER SUPPLY SCHEMATIC	
DRAWING NO.	REV. E
429-04212	SHEET 1 OF 2

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Figure 10-3 Cont'd

## Power Supply Schematic



-005

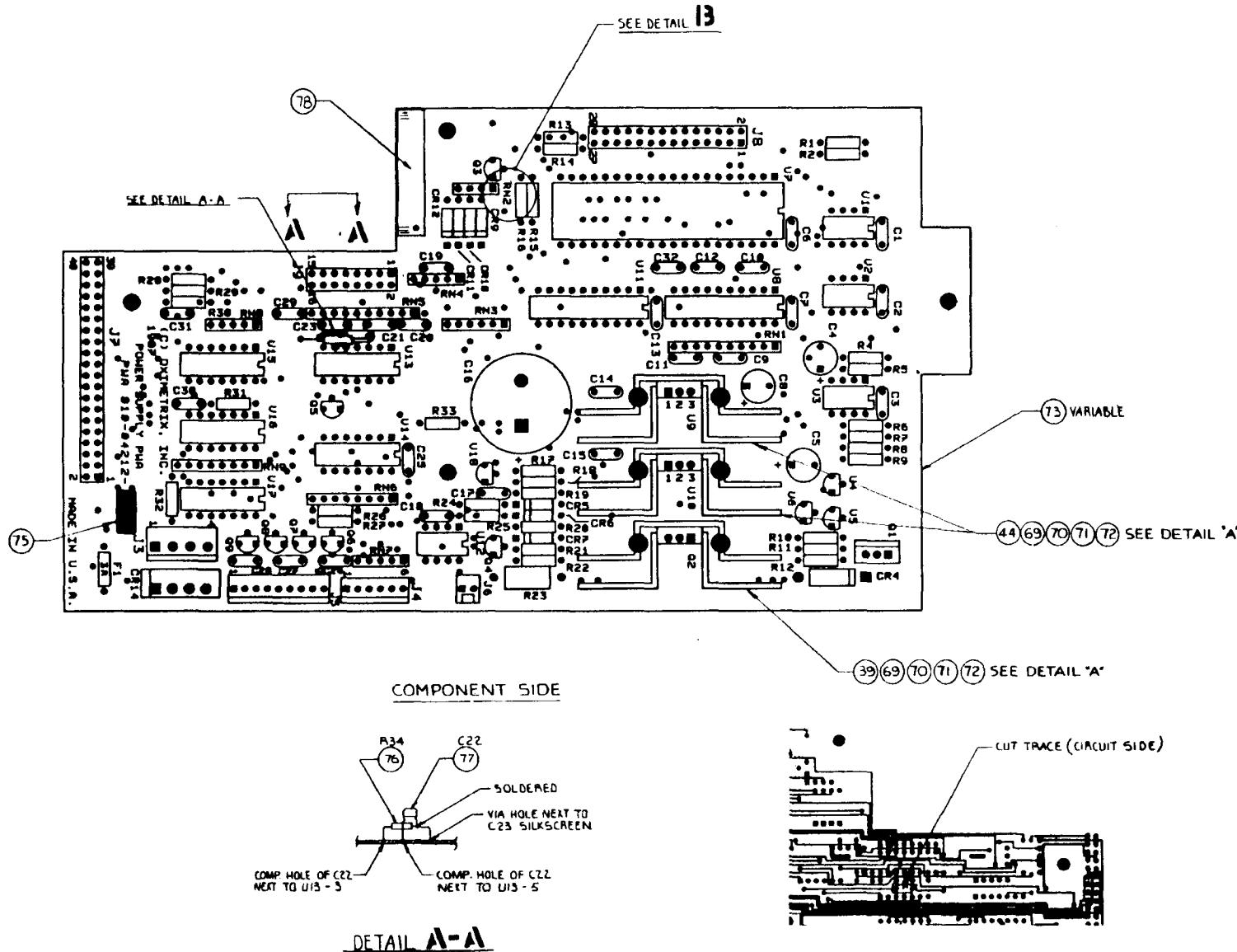
**ABBOTT LABORATORIES**  
**ABBOTT CRITICAL CARE**  
**AND CONTROL SYSTEMS**

## POWER SUPPLY SCHEMATIC

DRAWING NO.	REV. E
429-04212	SHEET 2 OF 2

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Figure 10-10-1  
Power Supply Asm



-006

ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
POWER SUPPLY ASM	
DRAWING NO.	REV. F
810-04212	SHEET 1 OF 1

Table 10-2 Power Supply Assembly Parts List

RE: DRAWING #810-04212-006

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
612-53501-901	DIODE, RECTIFIER, 1A, 50V	CR5, CR7
612-53526-001	DIODE, BRIDGE, RECTIFIER, 2A, 100V	CR14
612-53542-901	DIODE, SCHOTTKY, 1N5820	CR4
617-60015-019	RESISTOR, NETWORK, 5-SIP, COMMON 1 MEG, 5%	RN4
617-60015-020	RESISTOR, NETWORK, 5-SIP, COMMON 47K, 5%	R77
617-60015-021	RESISTOR, NETWORK, 5-SIP, COMMON 22K, 5%	RN8
617-60015-023	RESISTOR, NETWORK, A-PIN SIP, COMMON 47K	RN2
617-60020-010	RESISTOR, NETWORK, 8-SIP, SEPARATE, 2K, 5%	RN6
617-60020-013	RESISTOR, NETWORK, 8-SIP, SEPARATE, 100K, 5%	RN9
617-60020-014	RESISTOR, NETWORK, 10-SIP, SEPARATE, 47K, 5%	RN1
617-60020-015	RESISTOR, NETWORK, 6-SIP, SEPARATE, 100K, 5%	RN3
617-60020-016	RESISTOR, NETWORK, 10-SIP, SEPARATE, 1K, 5%	RN5
618-60175-901	RESISTOR, METAL FILM, 49.9K (PREP)	R8
618-60178-902	RESISTOR, METAL FILM, 110K (PREP)	R19
618-60179-901	RESISTOR, METAL FILM, 2.0K (PREP)	R4
618-60351-901	RESISTOR, METAL FILM, 39.7K (PREP)	R17
618-60381-901	RESISTOR, METAL FILM, 27.4K (PREP)	R7, R24
618-60382-901	RESISTOR, METAL FILM, 18.7K (PREP)	R5, R6
619-61042-901	RESISTOR, FIXED, 51, 5% 1/4W (PREP)	R21
619-60158-901	RESISTOR, FIXED, 220 Ohm (PREP)	R10, R15
619-61064-901	RESISTOR, FIXED, 390 Ohm (PREP)	R27
619-61066-901	RESISTOR, FIXED, 470 Ohm (PREP)	R1, R25
619-61072-901	RESISTOR, FIXED, 820 Ohm (PREP)	R16
619-61079-901	RESISTOR, FIXED, 1.5K Ohm (PREP)	R20
619-61083-901	RESISTOR, FIXED, 2.2K Ohm (PREP)	R14, R28
619-61087-901	RESISTOR, FIXED, 3.3K Ohm (PREP)	R30
619-61092-901	RESISTOR, FIXED, 5.1K Ohm (PREP)	R9, R22
619-61100-901	RESISTOR, FIXED, 10K Ohm (PREP)	R2, R33
619-61104-901	RESISTOR, FIXED, 15K Ohm (PREP)	R18
619-61108-901	RESISTOR, FIXED, 22K Ohm (PREP)	R12, R26
619-61112-901	RESISTOR, FIXED, 33K Ohm (PREP)	R11
619-61116-901	RESISTOR, FIXED, 47K Ohm (PREP)	R29, R32
619-61133-901	RESISTOR, FIXED, 220K Ohm (PREP)	R31
620-60417-902	RESISTOR, WIRE WOUND, 0.62" (PREP)	R23
625-54017-001	TRANSISTOR, PNP, SWITCHING	Q4
625-54035-001	TRANSISTOR, PNP, POWER TO-220 AB	Q1, Q2
628-54045-001	TRANSISTOR, VMOS, FET, N-CH	Q3, Q5-Q9
630-52007-002	IC, LM358N	U3, U12
630-52069-001	IC, LINEAR, 2.5V REG, LOW CURRENT	U5, U6
630-52105-001	IC, V REF, 2.5V, 0.2%	U4, U18
630-52106-001	IC, V REG, 5V, 1.5A	U9, U10
632-50112-001	IC, CMOS, COUNTER, OCTAC	U16
632-50145-001	IC, CMOS, OCTAL LATCH, 74HC373	U11
632-50181-001	IC, CMOS, NAND, QUAD, 2-INP	U17
632-50199-001	IC, CMOS, OCTAL BUFFER	U8
632-50403-001	IC, CMOS, EXCL OR QUAD	U15
632-50408-001	IC, NAND, QD 2-INP, SCHM TRIG	U14
632-50434-001	IC, CMOS, EXCL, NOR, QUAD 4077	U13
640-50642-001	IC, CMOS, PPI, 82055A	U7
649-55310-901	CAPACITOR, CERAMIC, .01 microF (PREP)	C19

Table 10-2 Power Supply Assembly Parts List (continued)

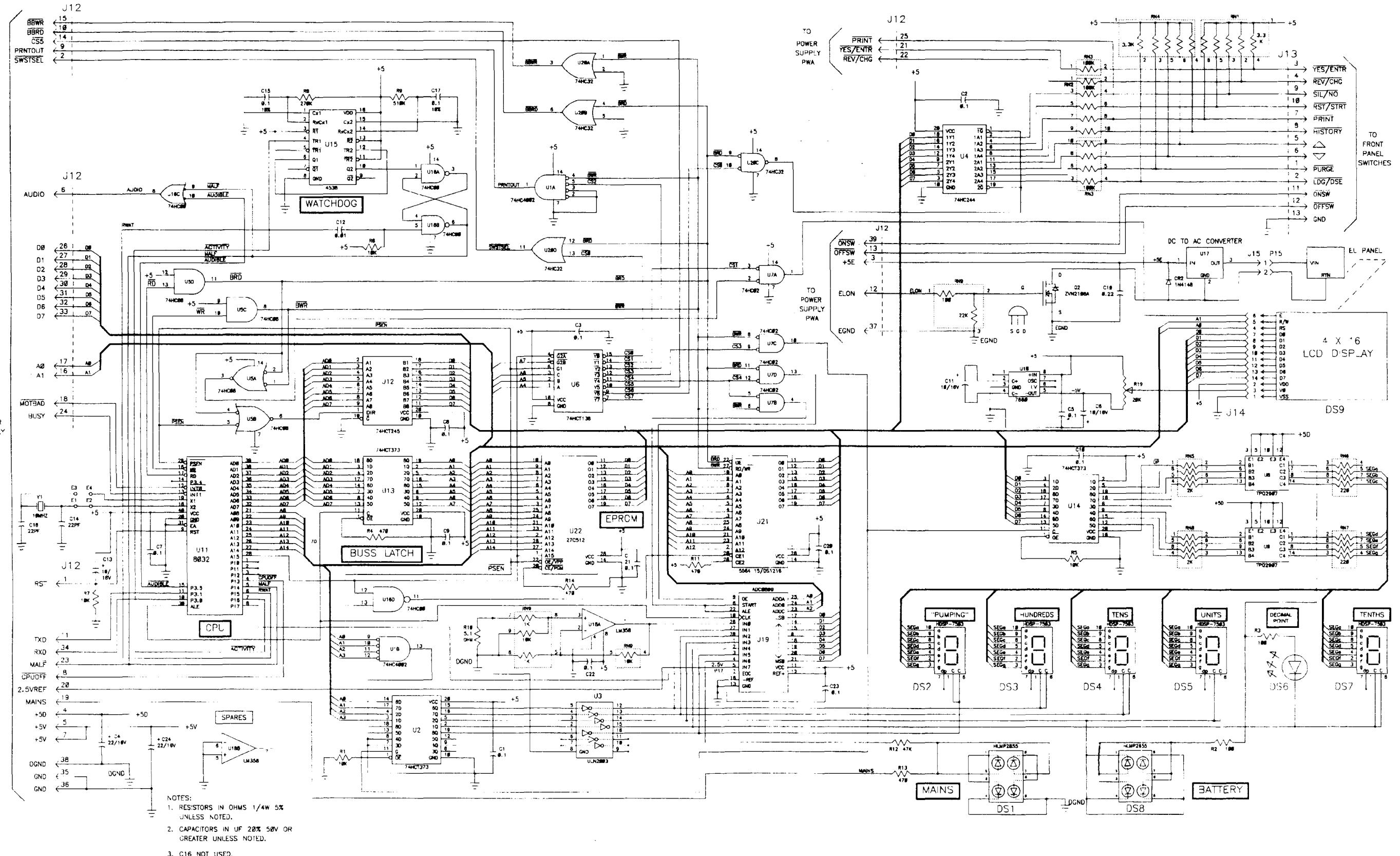
RE: DRAWING #810-04212-006

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
649-55316-901	CAPACITOR, CERAMIC, 220 pF (PREP)	C17
610-53503-901	DIODE, SIGNAL, 500 MW, 75V	CR6
610-53535-901	DIODE, IN6263	CR9-CR12
649-55404-902	CAPACITOR, CERAMIC, 0.1 microF, 50V (PREP)	C30
649-55405-901	CAPACITOR, CERAMIC, 0.1 microF (PREP)	C3, C6, C7, C9-C13, C18, C20, C21, C23, C25-C29, C31
649-55411-901	CAPACITOR, CERAMIC, .47 microF, 20% (PREP)	C14, C15
654-56768-901	CAPACITOR, TANTALUM, 22 microF	C4, C5, C8
654-57865-002	CAPACITOR, ALUMINUM, 2200 microF, 20%, 35V	C16
668-65147-001	CONNECTOR, MALE, BOARD MOUNTED, LOCKING, 4-PIN	J3
668-65183-027	CONNECTOR, MALE, BOARD MOUNTED, GOLD PLATED, 6-PIN	J4
668-65183-030	CONNECTOR, MALE, BOARD MOUNTED, LOCKING, 2-PIN	J6
668-65183-063	CONNECTOR, MALE, BOARD MOUNTED, STRAIGHT, DUAL, 28-PIN	J8
668-65183-055	CONNECTOR, MALE, DUAL, BOARD MOUNTED, 16-PIN	J9
668-65183-058	CONNECTOR, MALE, DUAL, BOARD MOUNTED, 40-PIN	J7
668-65183-059	CONNECTOR, MALE, BOARD MOUNTED, GOLD PLATED, 9-PIN	J5
670-72507-901	FUSE, 3.0 AMP, 125V	F1
686-71759-001	HEATSINK, BOARD MOUNTED, TO-220	REF Q2, U9, U10
686-71760-001	HEATSINK, BOARD MOUNTED, TO-220, STACKABLE	REF Q2, U9, U10
721-14171-002	WASHER, .121" INSIDE DIAMETER, .045" THICK, STEEL	REF Q2, U9, U10
722-12081-001	NUT, 4-40, HEX	REF Q2, Q9, U10
738-04212-004	PWB, POWER SUPPLY	AS REQUIRED
737-35115-001	SOLDER, 63137 1 LB, E-BAR	
735-36790-001	LABEL, PWA DATE CODE	
619-61150-001	RESISTOR, FIXED, 1M, 5%, 1/4 W	R34
649-55409-001	CAPACITOR, CERAMIC, .22 microF, 20%, 50V	C22
735-36959-001	LABEL, BAR CODE, TRACS	
649-55310-001	CAPACITOR, CERAMIC, .01 microF, 20%, 50V	C32
680-72604-001	TUBING, TEFLON	REF C32

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Figure 10-17

## CPU/Display Schematic



-002

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AND CONTROL SYSTEMS

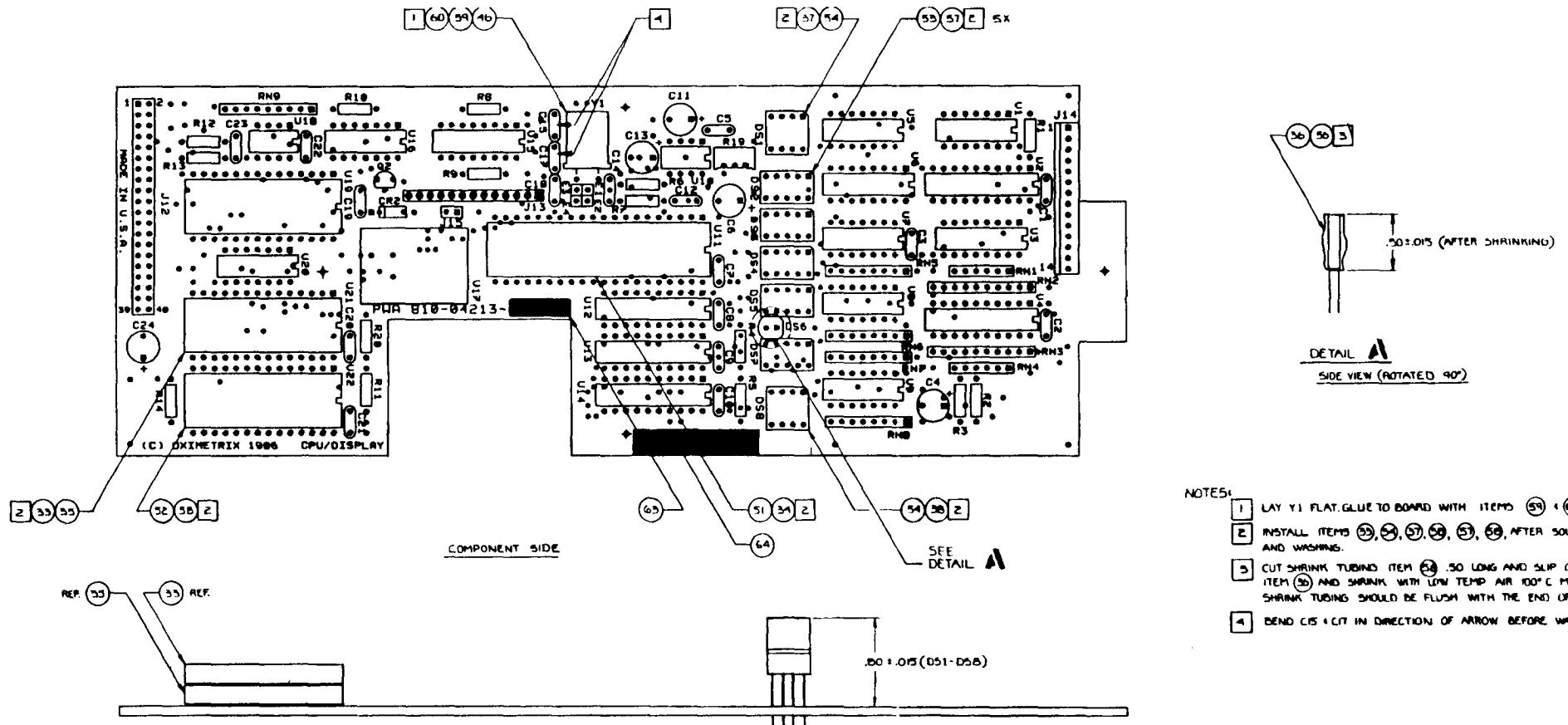
CPU/DISPLAY SCHEMATIC

DRAWING NO. 429-04213 REV. E  
SHEET 1 OF 1

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Figure 4-1

## CPU/Display Asm



-008

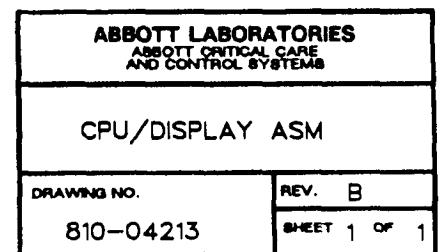


Table 10-3 CPU/Display Assembly

RE: DRAWING NO. 810-04213-008

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
619-61100-901	RESISTOR, FIXED, 10K	R1, R5, R6, R7
619-61116-901	RESISTOR, FIXED, 47K	R12
619-61135-901	RESISTOR, FIXED, 279K	R8
619-61142-901	RESISTOR, FIXED, 519K	R9
621-62021-001	POTENTIOMETER, 20K	R19
625-52045-002	TRANSISTOR ARRAY 2003	U3
625-52045-005	TRANSISTOR ARRAY 2907	U8, U9
626-63013-001	RESISTOR, NETWORK, CST	RN9
628-54045-001	TRANSISTOR, VMOS, FET, 2VN2106A, N-CH	Q2
630-52007-002	IC, OP-AMP, LOW POWER	U18
630-52070-001	V-CONVERTER 7660	U10
632-50145-002	IC, CMOS, OCTAL LATCH	U2, U13, U14
632-50199-001	IC, CMOS, OCTAL BUFFER	U4
632-50205-001	IC, HCMOS, QUAD 2-INPUT NAND GATE	U16
632-50214-002	IC, CMOS, DECODER/DEMUX	U6
632-50218-001	IC, HCMOS, NOR GATE, QUAD	U7
632-50222-002	IC, HCMOS, BUFFER	U12
632-50228-001	IC, HCMOS, GATE	U5
632-50236-001	IC, HCMOS, 2-INP, OR GATE	U20
632-50252-001	IC, HCMOS, DUAL NOR, '74HC4002	U1
632-50338-001	IC, CMOS, ONE-SHOT DUAL	U15
634-52534-001	IC, INTERFACE A-D, CONVERTER	U19
637-50634-001	IC, CMOS, IC, CMOS, RAM, STATIC 8K X 8 (PLUGS INTO U21)	U21
640-50641-001	IC, NMOS, CPU, 8032	U11
640-50644-001	IC, CMOS, REAL TIME CLOCK	\$12.60 + on 29-3-99 U21
648-70216-001	LED, LAMP, RED	DS6
648-70250-005	LED, BAR, GREEN, HLMP 2855	DS1
648-70250-006	LED, BAR, HI-EFF RED 2655	DS8
649-55007-901	CAPACITOR, CERAMIC, COG, 22 pF (PREP)	C14, C18
649-55306-901	CAPACITOR, CERAMIC, X7R, 0.1 microF, 10% (PREP)	C12
655-56356-002	CAPACITOR, POLY, FILM 0.1 microF, 5%, 50V	C15, C17
649-55405-901	CAPACITOR, CERAMIC, Z5U, 0.1 microF (PREP)	C1-C3, C5, C7-C10, C20-C23
649-55409-901	CAPACITOR, CERAMIC, Z5U, 0.22 microF (PREP)	C19
654-56768-901	CAPACITOR, TANTALUM, 22 microF (PREP)	C4, C24
654-56851-903	CAPACITOR, TANTALUM, 10 microF, 20%, 16V (PREP)	C6, C11, C13
667-71512-001	CRYSTAL, 10.0MHZ	Y1
668-65161-005	CONNECTOR, MALE, STRAIGHT, GOLD-PLATED, SOLDER, 2-PIN	J15
668-65183-058	CONNECTOR, MALE, DUAL, BOARD MOUNTED, 40-PIN	J12
668-65196-001	CONNECTOR, MALE, BOARD MOUNTED, RIGHT ANGLE, 13 PIN	J13
668-65233-001	CONNECTOR, 14-PIN, FEMALE, SINGLE LINE	J14
610-53503-901	DIODE SIG	CR2
617-60015-022	RESISTOR NETWORK, 6-SIP, COM, 3.3K OHM	RN1, RN4
617-60020-009	RESISTOR NETWORK, 8-SIP, SEPARATE 220 OHM, 5%	RN6, RN7

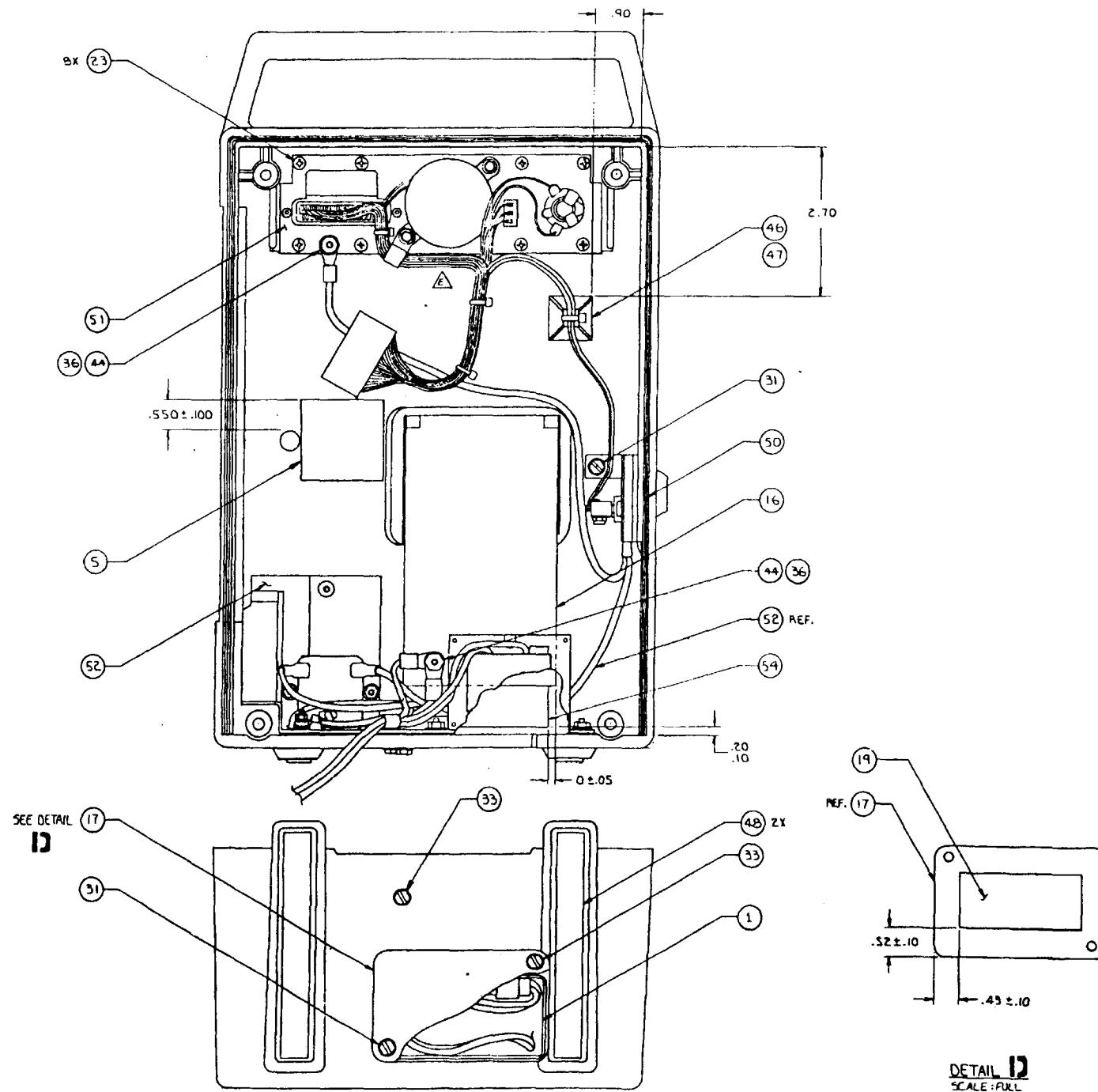
Table 10-3 PWA CPU/Display Assembly (continued)

RE: DRAWING NO. 810-04213-008

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
617-60020-010	RESISTOR, NETWORK, 8-SIP, SEPARATE, 2K, 5%	RN5, RN8
617-60020-017	RESISTOR, NETWORK, 10-SIP, SEPARATE, 100K	RN2, RN3
618-60387-901	RESISTOR, FIXED, 5.1K OHM	R10
619-61050-901	RESISTOR, FIXED, 100 OHM	R2, R3
619-61066-901	RESISTOR, FIXED, 470 OHM	R4, R11, R13, R14
668-65518-002	SOCKET, IC, 40-PIN	REF U11
668-65519-001	SOCKET, IC, 28-PIN	REF U22
668-65522-005	IC, SOCKET, WIRE WOUND, 0.2 CENTER, 10-PIN	REF DS2, DS3, DS4, DS5, DS7
673-69017-001	CONVERTER, E.L. DRIVER, 5 Vdc/70 Vac	U17
680-72574-001	TBG, SHRINK, 3/16" DIAMETER	REF DS6
692-70224-001	DISPLAY, HE RED, 7-SEG W/DECIMAL	DS2-DS5, DS7
815-04229-004	IC, PROM, PROMP, REV 1.07	U22
733-35116-001	ADHESIVE, TAK-PAK, LOCTITE	AS REQUIRED
733-35117-001	ACCELERATOR, TAK-PAK, LOCTITE	AS REQUIRED
738-04213-003	PWB, CPU/DISPLAY	
737-35115-001	SOLDER, 63/37 1LB E-BAR	AS REQUIRED
735-36790-001	LABEL, PWA DATE CODE	
668-65522-006	IC, SOCKET, WIRE WOUND, 0.3 CENTER, 8-PIN	DS1, DS8

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Figure 10-5  
Rear Case Asm



-001

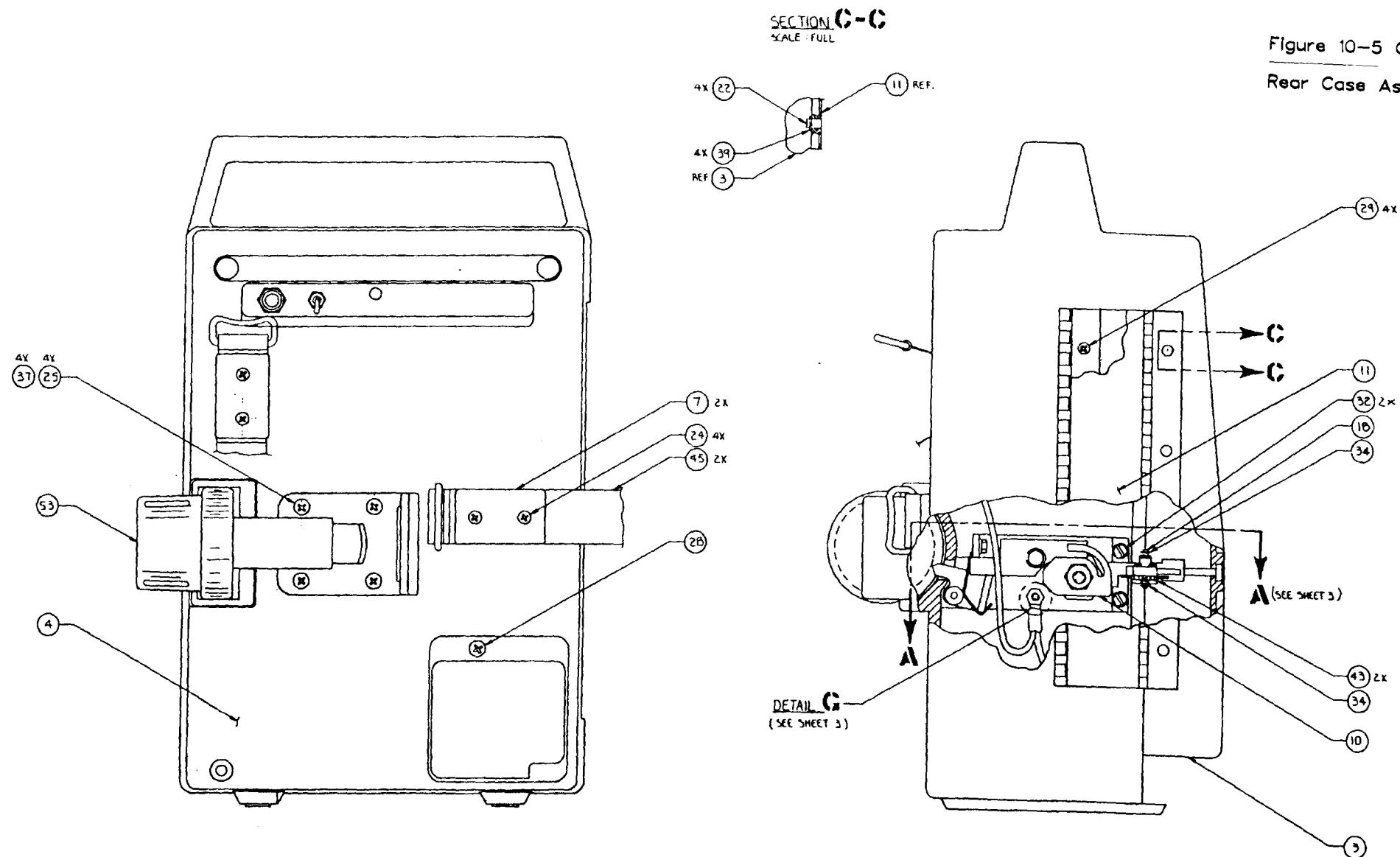
DETAIL 17  
SCALE: FULL

ABBOTT LABORATORIES ABBOTT OPTICAL CARE AND CONTROL SYSTEMS	
REAR CASE ASM	
DRAWING NO.	REV. E
840-04332	
SHEET 1 OF 3	

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Figure 10-5 Cont'd

Rear Case Asm

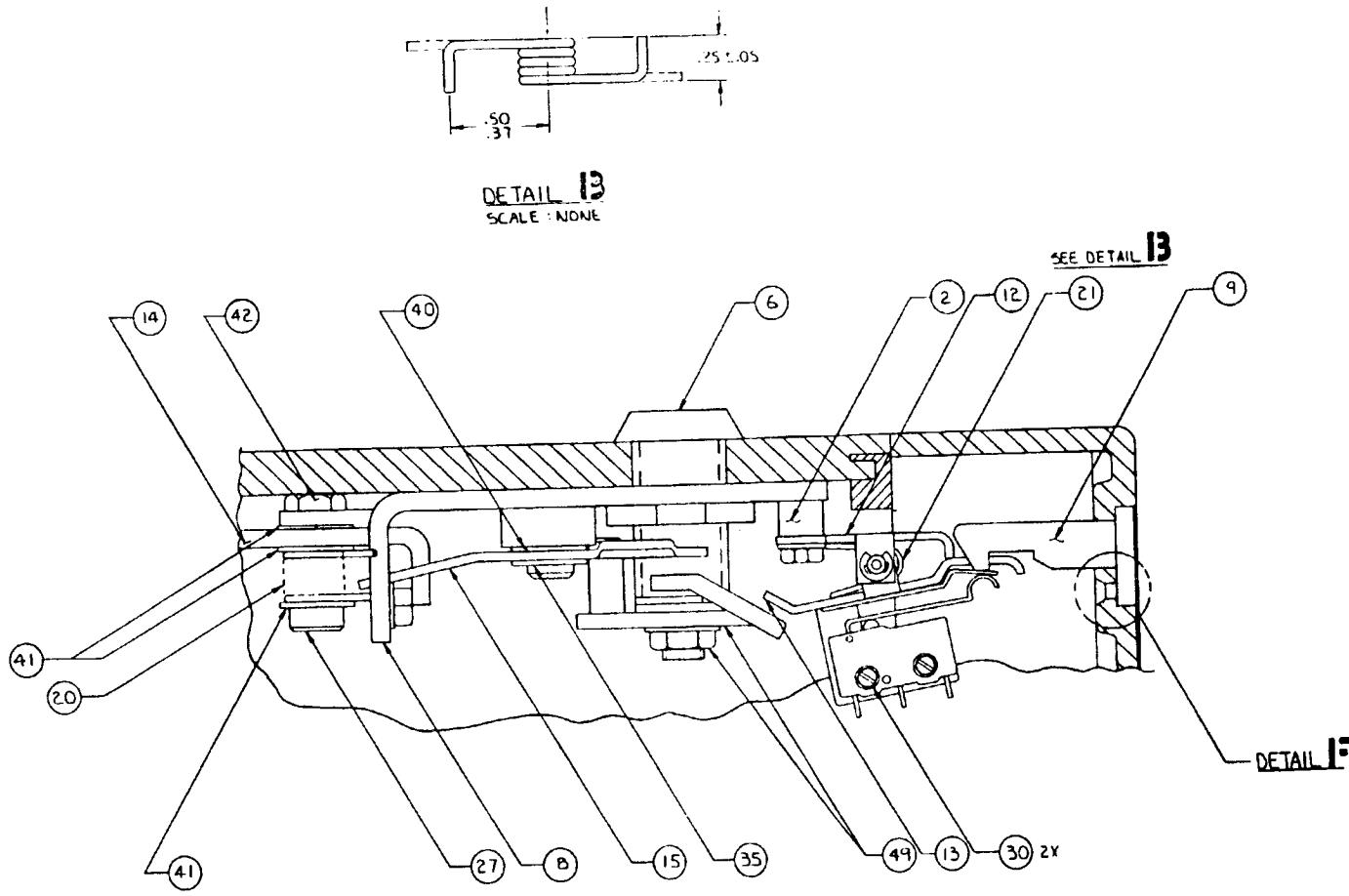


-001

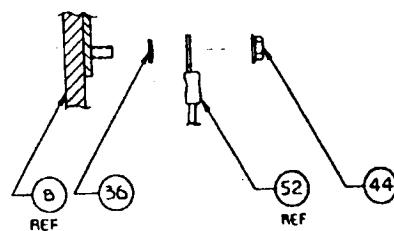
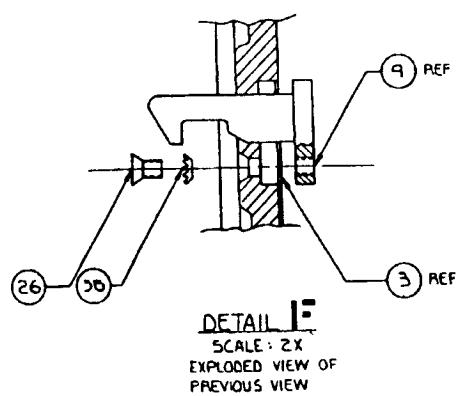
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
REAR CASE ASM	
DRAWING NO.	REV. E
840-04332	SHEET 2 OF 3

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Rear Case Asm



SECTION A-A



DETAIL C  
SCALE: FULL  
EXPLODED SIDE VIEW  
OF PREVIOUS VIEW

-001

<b>ABBOTT LABORATORIES</b> <b>ABBOTT CRITICAL CARE</b> <b>AND CONTROL SYSTEMS</b>	
<b>REAR CASE ASM</b>	
<b>DRAWING NO.</b> <b>840-04332</b>	<b>REV. E</b> <b>SHEET 3 OF 3</b>

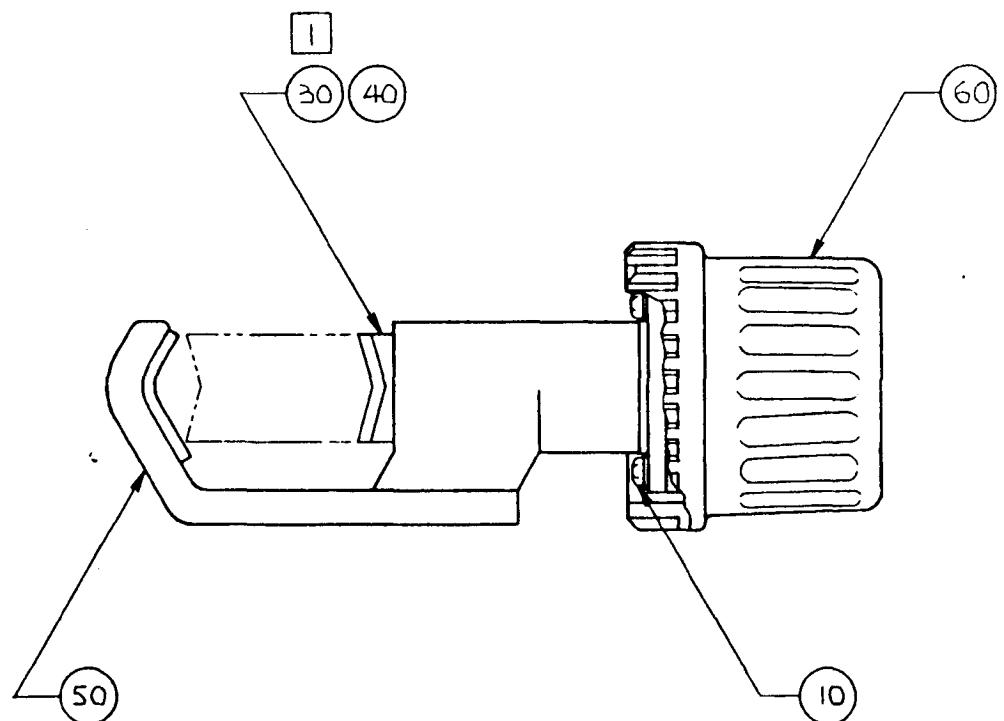
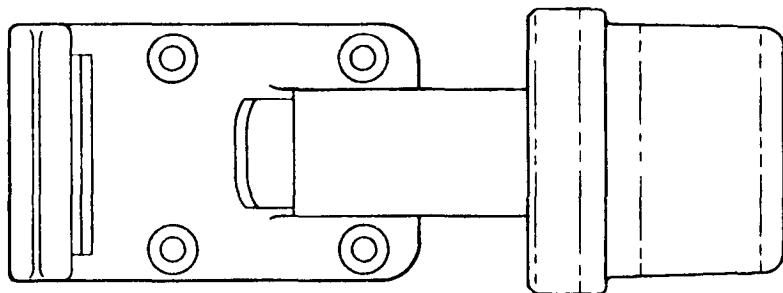
Table 10-4 Rear Case Assembly

RE: DRAWING NO. 840-04332-001

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
642-76002-002	BATTERY, W/CONNECTOR, RECHARGE	1
709-04074-004	SPACER, DOOR LATCH	2
712-04084-002	DOOR 840-04476-003-\$41.46. door assy 8/02 vs	3
712-04224-001	CASE, REAR, GREY	4
712-04344-001	INSULATOR, 1.5" X 1.5"	5
713-73575-001	CYLINDER LOCK, STEEL, NICKEL-PLATED	6
714-04006-005	RETAINER, POWER CORD	7
714-04073-002	PLATE, SUPPORT	8
727-04283-001	LATCH, HOOK, DOOR	9
714-04078-004	LATCH, HOOK, DOOR	10
714-04088-003	HINGE, DUAL	11
714-04097-002	SUPPORT, LATCH	12
714-04098-005	LATCH, DOOR	13
714-04100-003	POLE CLAMP, RATCHET, PAWL	14
714-04115-002	POLE, LOCK, RIGHT	15
714-04210-001	BOX, BATTERY	16
714-04218-001	COVER, BATTERY	17
715-04077-002	PIN, PIVOT, DOOR LATCH	18
716-84070-003	PAD, FOAM	19
717-04159-002	SPRING, TORSION, LATCH, KNOB PAWL	20
717-23081-001	SPRING, TORSION, .025" DIAMETER	21
718-15004-001	SOLID RIVET, .125" DIAMETER X 38" LENGTH	22
720-10114-001	SCREW, 4-24 X .375", CUTTING THREAD	23
720-10132-001	SCREW, 6-32 X 1/4", FLAT HEAD	24
720-10133-010	SCREW, 8-32 X .562", FLAT HEAD, PHILLIPS HEAD	25
720-10139-004	SCREW, 4-40 X 1/4", FLAT HEAD, PHILLIPS HEAD	26
720-10143-001	SCREW, 10-32 X 1/2", SHOULDER	27
720-10181-001	SCREW, 6-32 X 1/4", PAN HEAD	28
720-10189-001	SCREW, 4-40 X 1/4", PAN HEAD, PHILLIPS HEAD	29
720-10321-002	SCREW, 2-56 X 1/2", HEX, WASHER	30
720-10325-003	SCREW, 6-32 X 5/16", HEX HEAD, W/WASHER	31
720-10325-004	SCREW, 6-32 X 3/8", HEX HEAD, SLOTTED	32
720-10325-006	SCREW, 6-32 X 1/2", HEX HEAD, SLOTTED	33
721-13103-001	RING, RETAINING, .12 SFT	34
721-13105-001	RING, RETAINING, .312 SFT	35
721-14102-001	WASHER, LOCK, #6, EXTERNAL TOOTH	36
721-14103-001	WASHER, LOCK, EXT, CONICAL	37
721-14105-001	WASHER, LOCK, #4, EXTERNAL TOOTH, CARBON	38
721-14111-001	WASHER, FLAT, #6, .032" THICK	39
721-14181-016	WASHER, BRASS	40
721-14181-017	WASHER, BRASS	41
722-12001-001	NUT, 10-32, HEX	42
722-12092-001	NUT, 2-56, HEX, SELF-LOCKING	43
722-12101-004	NUT, 6-32, KEP, W/CONICAL WASHER	44
725-36531-003	STRAP, VELCRO HOOK	45
725-72261-001	TIE, CABLE	46
725-72283-002	MOUNT, CABLE TIE, PLASTIC	47
730-04008-003	FOOT, CASE, REAR	48
733-35011-001	ADHESIVE, ANAEROBIC, #242	49
765-04079-003	GASKET, PCAII	50
830-04079-002	ASSEMBLY, CONTROL PANEL	51
830-04334-001	ASSEMBLY, TRANSFORMER/RECEPTACLE, LC4200	52
840-04080-006	ASSEMBLY, POLE CLAMP 140-37	53
735-01443-006	LABEL, BATTERY	54
733-35120-001	ADHESIVE	55

Account # 327536

Figure 10-6  
Pole Clamp Asm



24.98 t.

L  
735-04348-004  
\$21.78 t.

712-04348-003  
\$112.48 t.

NOTES:

APPLY ITEM (30) TO ROD SCREW OF ITEM (60)

-006

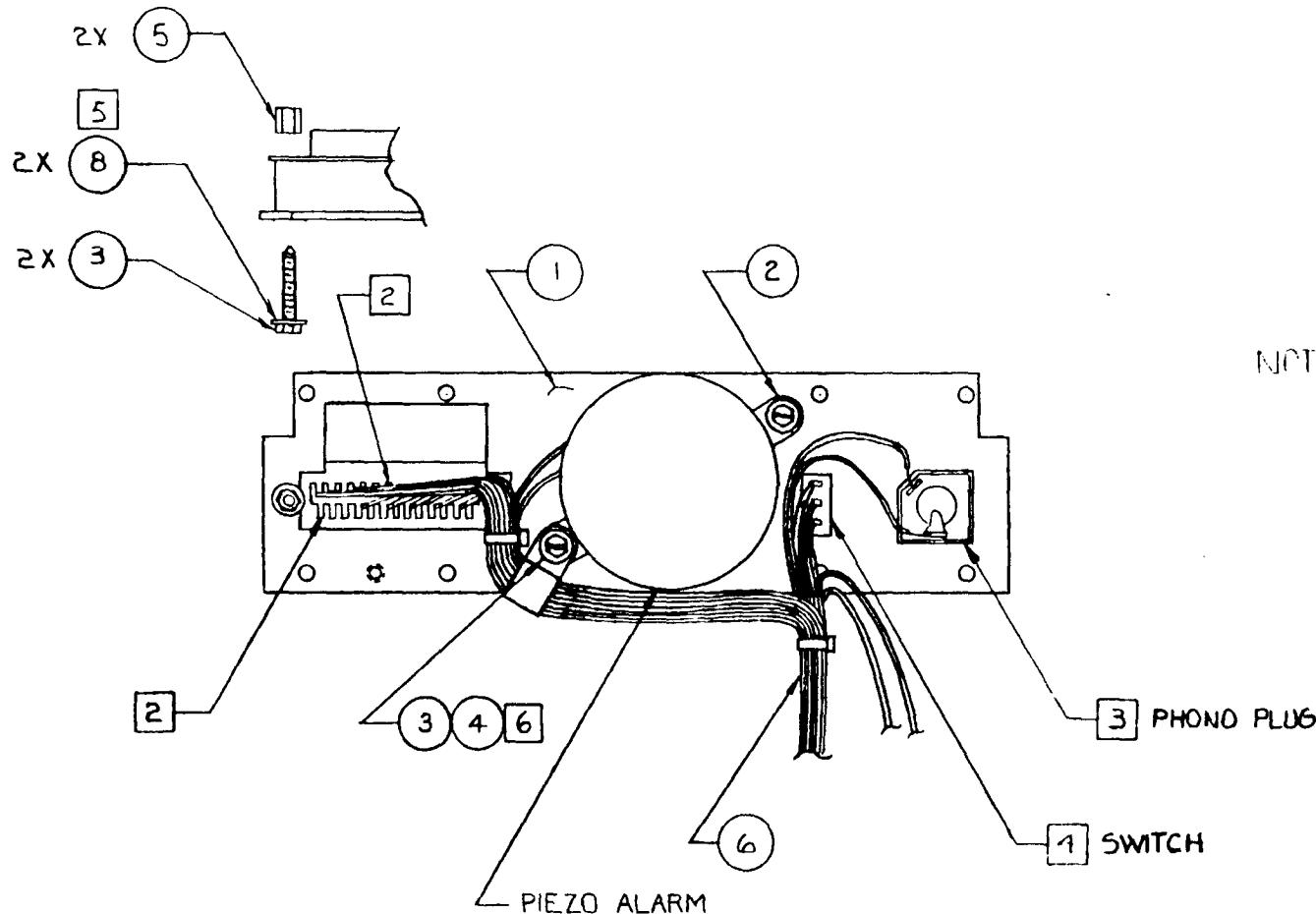
ABBOTT LABORATORIES ABBOTT OPTICAL CARE AND CONTROL SYSTEMS	
POLE CLAMP ASM	
DRAWING NO.	REV.
840-04080	SHEET 1 OF 1

**Table 10-5 Pole Clamp Assembly**

RE: DRAWING NO. 840-04080-006

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
720-10323-004	SCREW, 4-40 X 3/8", HEX HEAD, SLOTTED, W/WASHER	10
733-35017-001	LUBRICANT, MULTIPURPOSE, WHITE	30
727-04267-001	PLUNGER, PAD POLE CLAMP	40
727-04269-002	HOUSING, POLE CLAMP	50
840-04095-006	ASSEMBLY, KNOB SHAFT	60

Figure 10-7  
Control Panel Asm



NOTES:

1. ASSEMBLY TO BE INDIVIDUALLY BOXED.
2. HARNESS TO BE AS FLAT TO PLATE AS POSSIBLE.
3. INSTALL PHONO JACK AGAINST UNPAINTED SURFACE OF ITEM ①. PLACE FLAT WASHER AGAINST PAINTED SURFACE. THEN NUT AGAINST WASHER.
4. THE LOCKWASHER FROM THE SWITCH IS PLACED BETWEEN THE SWITCH AND THE UNPAINTED SURFACE OF ITEM ①. ONE NUT IS PLACED AGAINST THE PAINTED SURFACE.
5. ADD ITEM ⑧ TO SCREW ITEM ③, AND NOT TO HEX SPACER ITEM ⑤.
6. ITEM 4, CABLE CLAMP, IS MOUNTED UPSIDE-DOWN (-002 ONLY).

-002

ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
CONTROL PANEL ASM	
DRAWING NO.	REV. H
830-04221	SHEET 1 OF 2

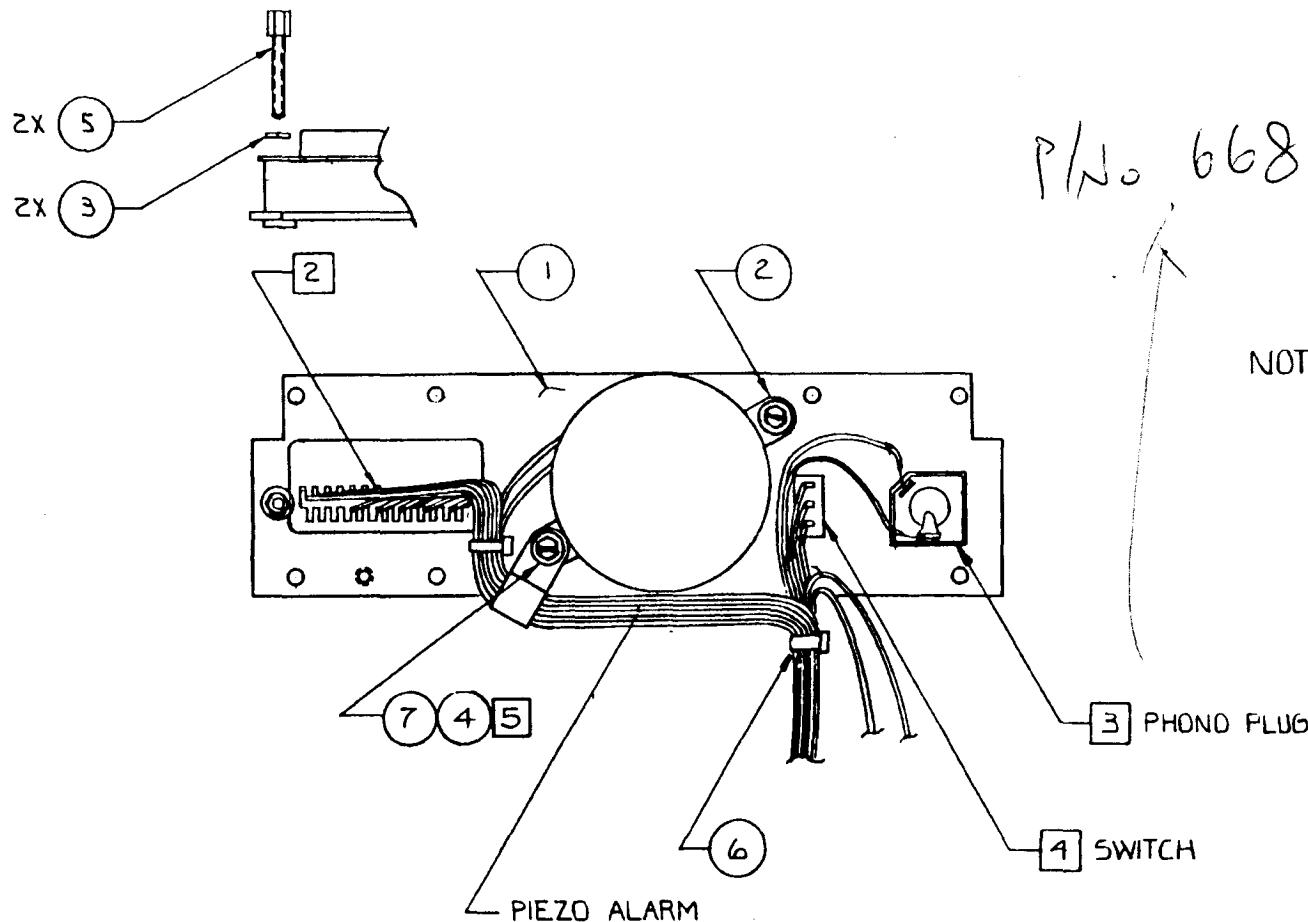
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Figure 10-7, Cont'd

Control Panel Asm

Key 713-73576-013  
\$ 1.98.

P/N 668-65044-001  
\$ 9.13.



NOTES:

1. ASSEMBLY TO BE INDIVIDUALLY BOXED.
2. HARNESS TO BE AS FLAT TO PLATE AS POSSIBLE.
3. INSTALL PHONO JACK AGAINST UNPAINTED SURFACE OF ITEM 1. PLACE FLAT WASHER AGAINST PAINTED SURFACE, THEN NUT AGAINST WASHER.
4. THE LOCKWASHER FROM THE SWITCH IS PLACED BETWEEN THE SWITCH AND THE UNPAINTED SURFACE OF ITEM 1. ONE NUT IS PLACED AGAINST THE PAINTED SURFACE.
5. ITEM 4, CABLE CLAMP, TO BE MOUNTED UPSIDE-DOWN (-003 ONLY).

-003

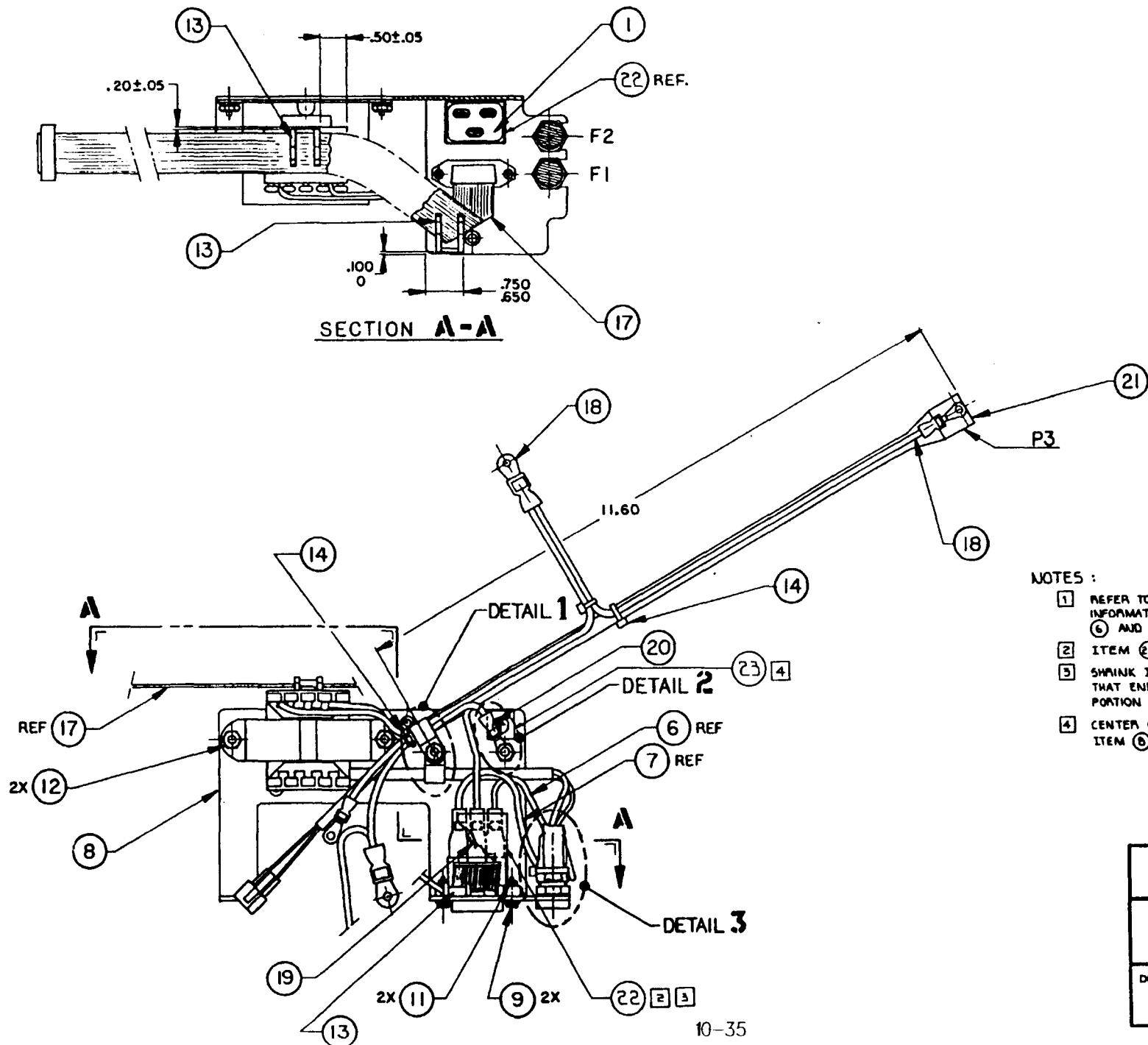
ABBOTT LABORATORIES ABBOTT OPTICAL CARE AND CONTROL SYSTEMS	
CONTROL PANEL ASM	
DRAWING NO.	REV. H
830-04221	SHEET 2 OF 2

Table 10-6 Control Panel Assembly

RE: DRAWING NO. 830-04221-002, 003

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
714-04070-003	PLATE, CONTROL	1
720-10323-004	SCREW, 4-40 X 3/8", HEX HEAD, SLOTTED, W/WASHER	2
720-10323-007	SCREW, 4-40 X 5/8", HEX HEAD, SLOTTED, W/WASHER	3
725-72279-012	CABLE CLAMP, NYLON OR EQUIVALENT, 1/4, #10	4
723-17053-004	SPACER, HEX, 4-40 X 0.188"	5
826-04247-003	ASSEMBLY, HARNESS, CONTROL PANEL	6
733-35011-001	ADHESIVE, ANAEROBIC, #242 AS REQUIRED	8

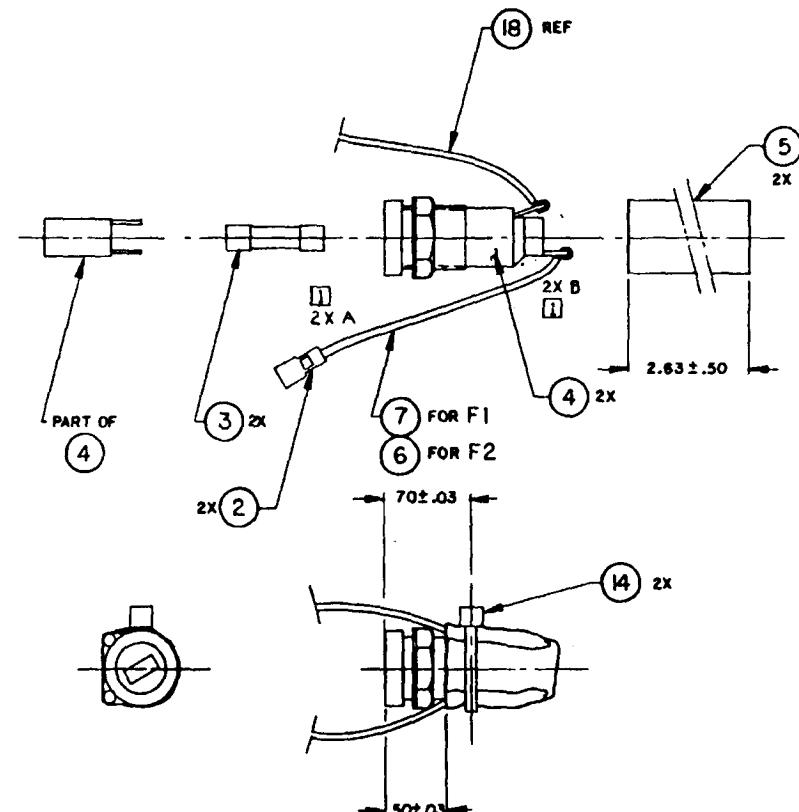
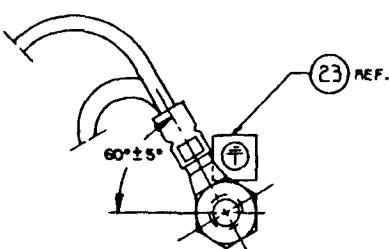
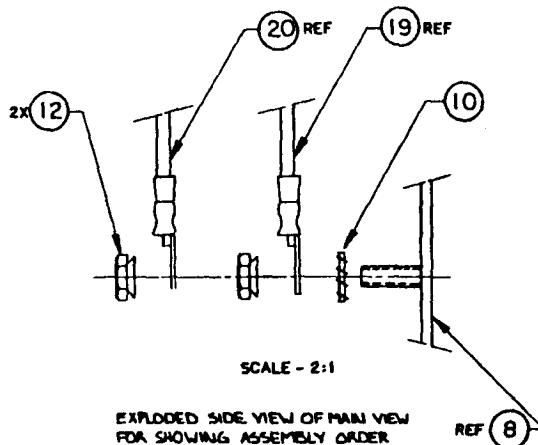
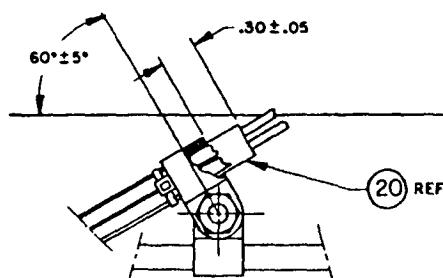
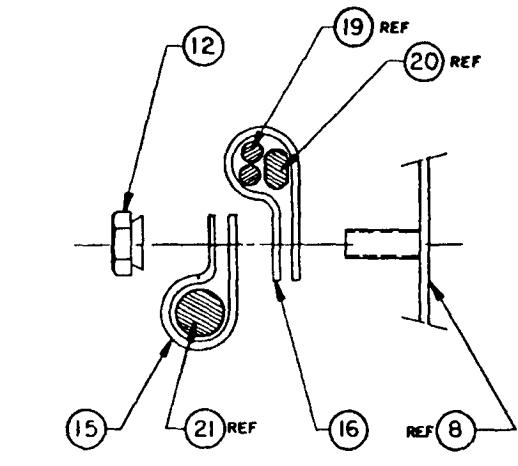
Figure 10-8  
Trans/Receptacle  
Asm



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Figure 10-8 cont'd

Trans/Receptacle  
Asm



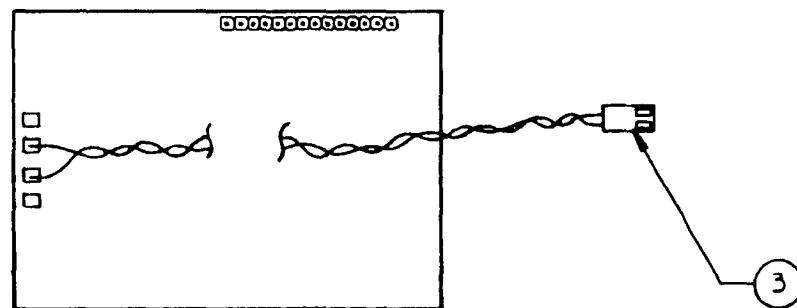
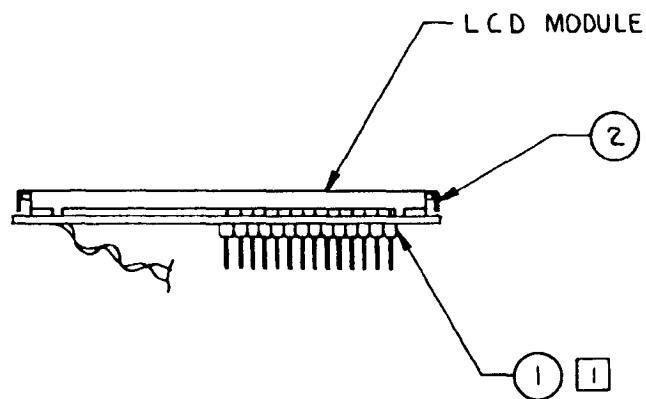
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
TRANS/RECEPTACLE ASM	
DRAWING NO.	REV. C
830-04334	SHEET 2 OF 2

Table 10-7 Transformer/Receptacle Assembly

RE: DRAWING NO. 830-04334-001

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
668-65707-003	RECEPTACLE, LINE CORD, AC, PANEL	1
668-72367-003	TERMINAL, FEM, SLIP-ON, 22/1	2
670-72525-003	FUSE, .125A, 5X20MM, TIM	3
670-72555-002	HOLDER, FUSE, 5X20MM	4
680-72588-001	TBG, SHRINK, 1/2" INSIDE DIAMETER	5
681-67261-064	WIRE, C/S, .458", 681-67	6
681-67261-065	WIRE, C/S, .520", 681-67	7
714-04335-001	BRACKET, TRANSFORMER/RECEPTACLE,	8
720-10323-004	SCREW, 4-40 X 3/8", HEX HEAD, SLOTTED, W/WASHER	9
721-14102-001	WASHER, LOCK, #6, EXTERNAL TOOTH	10
722-12081-001	NUT, 4-40, HEX, CD PLATED, SM	11
722-12101-004	NUT, 6-32, KEP, W/CONICAL WASHER	12
678-72302-001	CLIP, CABLE, FLAT, W/ADHESIVE	13
725-72262-001	TIE, CABLE	14
725-72279-007	CLIP, CABLE, 3/16, #8	15
725-72279-010	CLIP, CABLE, 5/16, #10	16
826-04222-002	ASSEMBLY, CABLE, D-SUB, 15-COND COND	17
826-04244-002	ASSEMBLY, GROUND WIRE, 3 TERM	18
826-04285-001	2 TERM, GROUND WIRE	19
826-04286-001	ASSEMBLY, HARNESS, GROUND WIRE, 4 TERM	20
830-04358-001	ASSEMBLY, TRANSFORMER, INT'L	21
830-04358-002	ASSEMBLY, TRANSFORMER, JAPAN	21

Figure 10-9  
LCD Display Asm



NOTES :

1) INSTALL ITEM ①,③ ON CIRCUIT SIDE OF ITEM ②.  
SOLDER BY HAND. CLEAN CAREFULLY. CLEANING  
SOLVENT MUST NOT CONTACT LCD MODULE.

-001

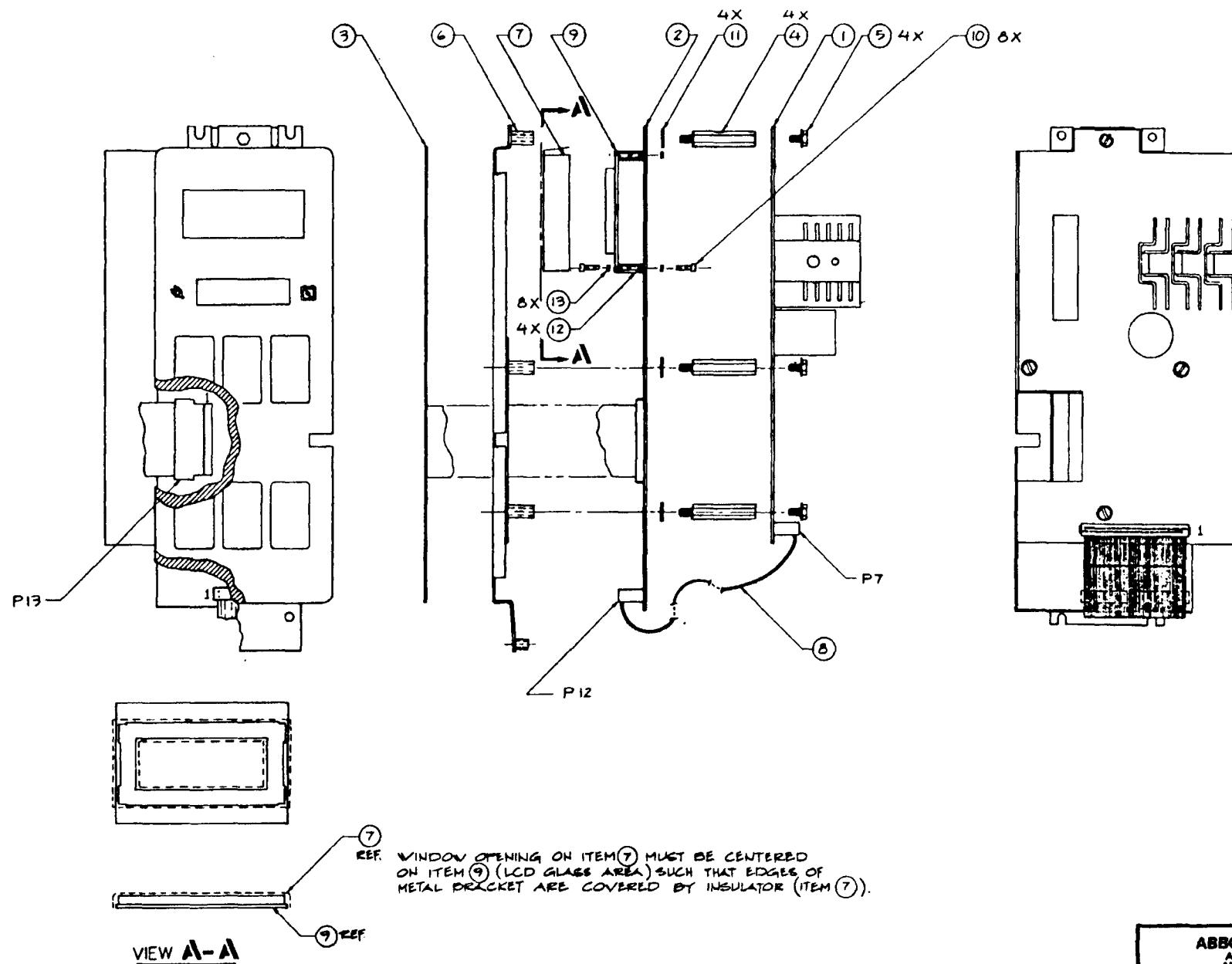
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
LCD DISPLAY ASM	
DRAWING NO.	REV. A
830-04227	SHEET 1 OF 1

**Table 10-8 LCD Display Assembly**

**RE: DRAWING NO. 830-04227-001**

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
668-65233-002	CONNECTOR, 14-PIN, MALE, SINGLE LINE	1
692-70260-001	LCD MODULE, 4X16 CHARACTER DOT MATRIX	2
826-04237-001	ASSEMBLY, HARNESS, E.L. PANEL	3

Figure 10-10  
Electronics Asm



-003

ABBOTT LABORATORIES ABBOTT OPTICAL CARE AND CONTROL SYSTEMS	
ELECTRONICS ASM	
DRAWING NO.	REV. F
830-04320	SHEET 1 OF 1

**Table 10-9 Electronics Assembly**

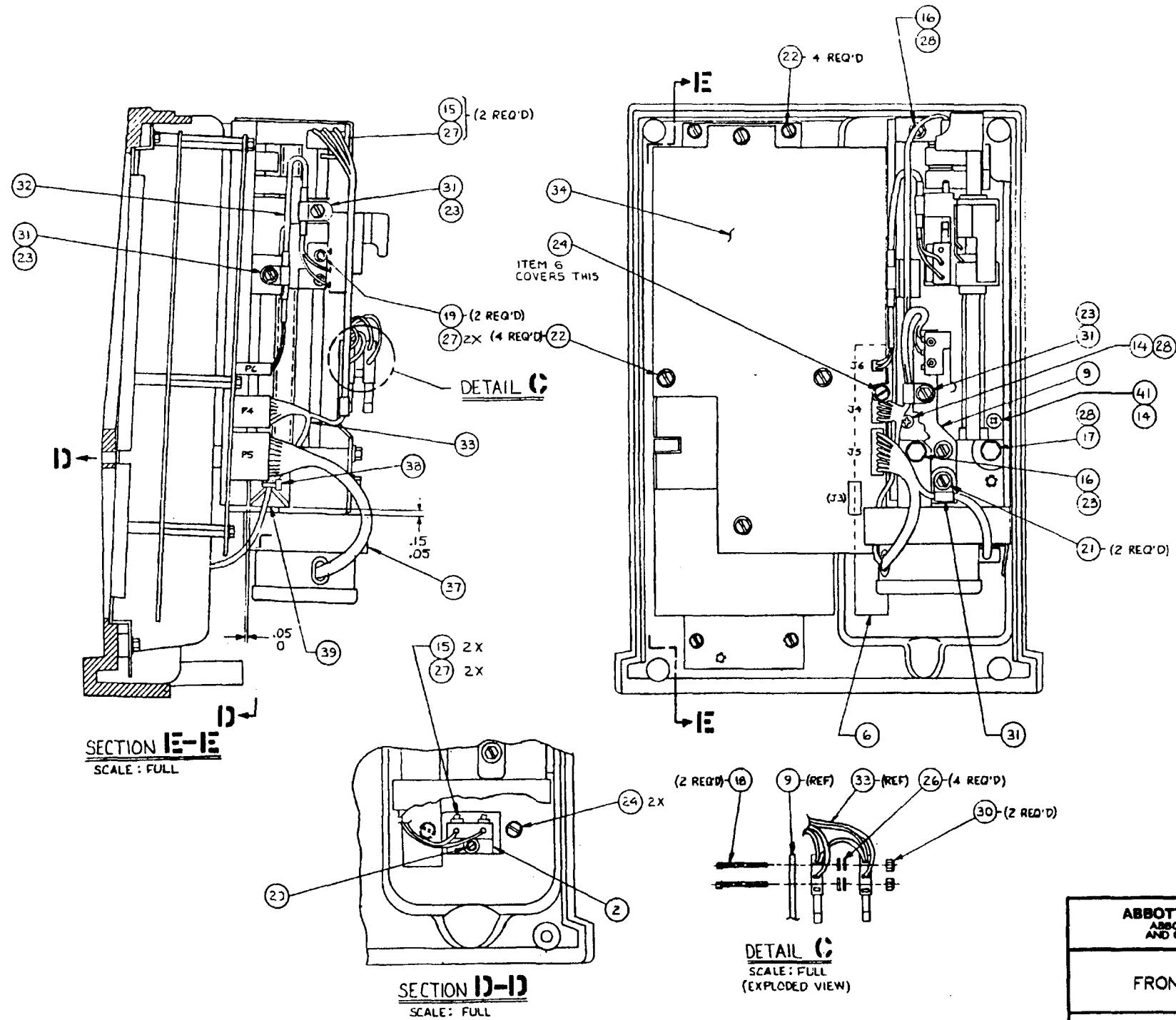
RE: DRAWING NO. 830-04320-003

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
810-04212-003	PWA, POWER SUPPLY	1
810-04213-005	PWA, CPU	2
812-04319-002	PANEL, FRONT, LC4200	3
723-17101-001	SPACER, HEX M&F 6-32 THD X 1.125	4
720-10325-003	SCREW, 6-32 X 5/16", HEX HEAD, W/WASHER	5
714-04180-002	PANEL, SUB	6
680-04233-003	INSULATOR, ADHESIVE-BACKED, CLEAR	7
826-04232-001	ASSEMBLY, CABLE 40 COND.	8
830-04227-001	ASSEMBLY, LCD DISPLAY	9
720-10152-001	SCREW, 2-56 X 1/4", HEX	10
721-14071-001	WASHER, FLAT, #6, NYLON	11
723-17059-002	HEX, 2-56 X .50L, BRONZE/NICKEL PLATED	12
721-14017-001	WASHER, FLAT, #2, .025" THICK, STEEL	13

Figure 10-11

---

Front Case Asm



-004

**ABBOTT LABORATORIES**  
**ABBOTT CRITICAL CARE**  
**AND CONTROL SYSTEMS**

### FRONT CASE ASM

**DRAWING NO.**

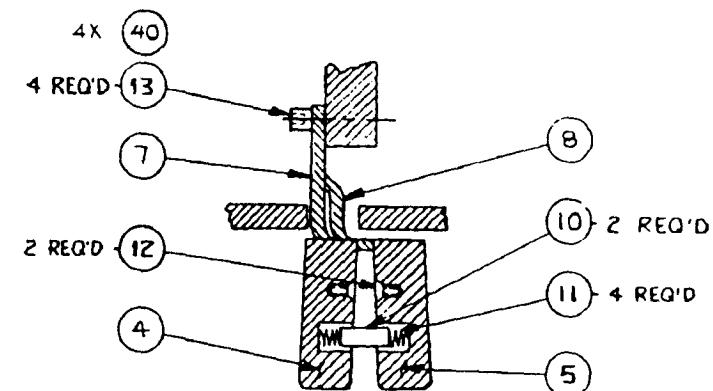
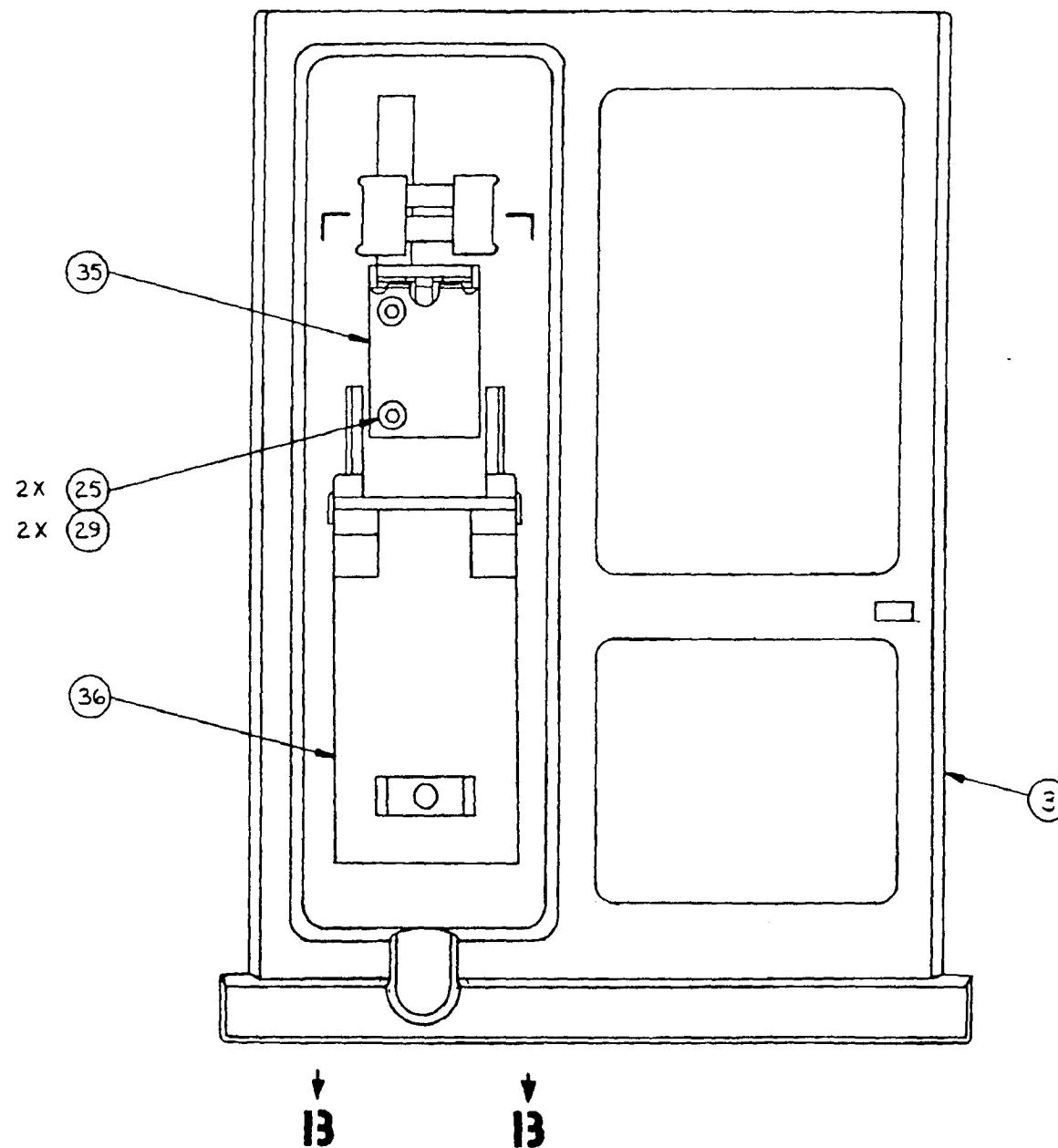
REV. C

SHEET 1 OF 2

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Figure 10-11, Cont'd

Front Case Asm



SECTION 13-13

-004

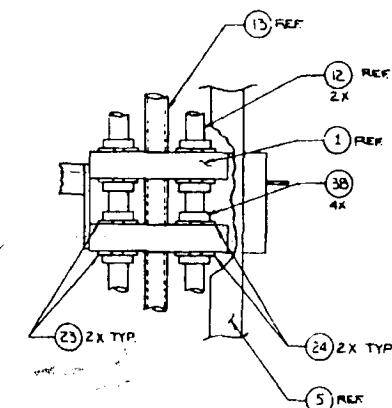
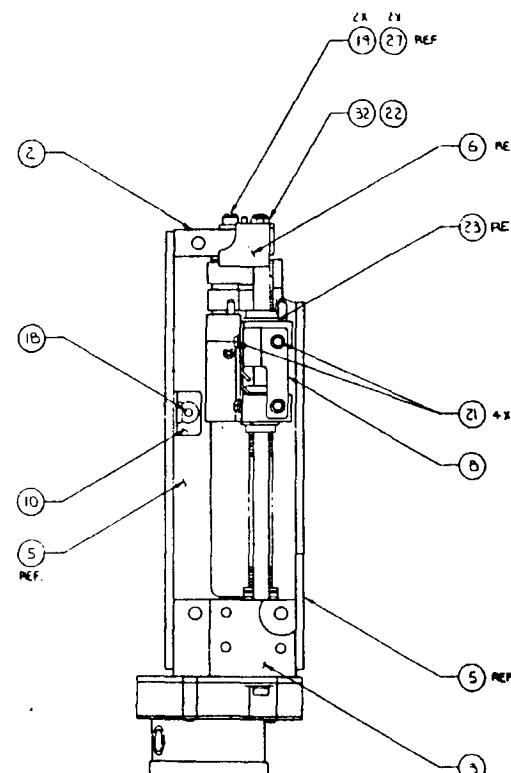
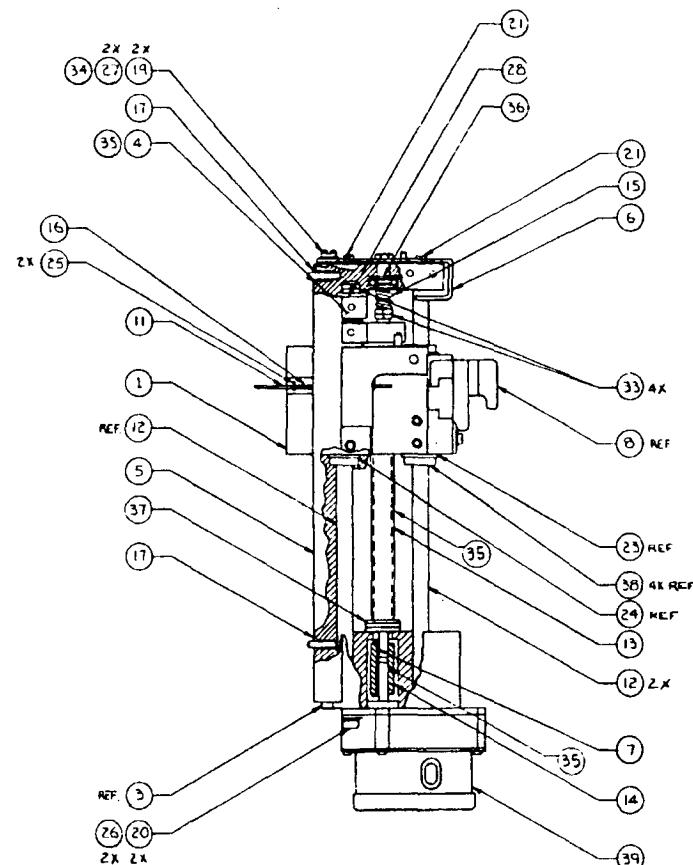
ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
FRONT CASE ASM	
DRAWING NO.	REV. C
830-04313	SHEET 2 OF 2

Table 10-10 Front Case Assembly

RE: DRAWING NO. 840-04313-004

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
709-04155-001	MOUNT, SWITCH, SYRINGE BODY	1
712-04314-001	MOUNT, SW, LC4200	2
712-04316-001	CASE, FRONT, LC4200	3
712-04338-001	KNOB, SLIDE, LEFT	4
712-04339-001	KNOB, SLIDE, RIGHT	5
712-04355-001	INSULATOR, 5" X .75"	6
714-04018-004	LEVER, KNOB, LEFT, LC4200	7
714-04019-003	LEVER, KNOB, RIGHT	8
714-04151-002	BRACKET, SW	9
715-04017-002	HOLDER, SPRING, KNOB	10
717-23053-001	COMPRESSION SPRING, .180" OUTSIDE DIAMETER X 625" LENGTH	11
720-10139-004	SCREW, 4-40 X .250", FLAT HEAD, PHILLIPS HEAD	12
720-10153-003	SCREW, 4-40 X .375", SOCKET HEAD	13
720-10216-001	SCREW, 10-32 X 5/16", PAN HEAD, PHILLIPS HEAD	14
720-10321-002	SCREW, 2-56 X 1/2", HEX WASHER, ROUND HEAD	15
720-10321-004	SCREW, 10-32 X 1.14", HEX WASHER, ROUND HEAD	16
720-10321-005	SCREW, 10-32 X 2.50", HEX WASHER, ROUND HEAD	17
720-10321-006	SCREW, 2-56 X .875", HEX WASHER, ROUND HEAD	18
720-10323-007	SCREW, 4-40 X 5/8", HEX HEAD, SLOTTED, W/WASHER	19
720-10323-008	SCREW, 4-40 X 3/4", HEX HEAD, SLOTTED, W/WASHER	20
720-10324-004	SCREW, 8-32 X 3/8", HEX HEAD, W/WASHER	21
720-10325-002	SCREW, 6-32 X 1/4", HEX HEAD, SLOTTED, W/WASHER	22
720-10325-003	SCREW, 6-32 X 5/16", HEX HEAD, W/WASHER	23
720-10325-006	SCREW, 6-32 X 1/2", HEX HEAD, SLOTTED, W/WASHER	24
720-10242-001	SCREW, 8-32 X .75", BUTTON HEAD, HEX SOCKET	25
721-14025-001	WASHER, FLAT, 0.094" INSIDE DIAMETER X .250" OUTSIDE DIAMETER	26
721-14032-001	WASHER, LOCK, #2,.020" THICK, SPECIAL CARBON STEEL	27
721-14143-001	WASHER, CURVED SPRING, #6, 402" OUTSIDE DIAMETER	28
721-14039-001	WASHER, LOCK-SPLIT, HELICAL, SPRING, #8	29
722-12092-001	NUT, 2-56, HEX	30
725-72279-002	CLIP, CABLE, 1/8", #10 BLT HOLE	31
826-04243-001	ASSEMBLY, CABLE, SYRINGE BODY SWITCH	32
826-04357-001	ASSEMBLY, HARNESS, SLIDE MECH	33
830-04320-002	ASSEMBLY, ELECTRONICS,LC4200	34
840-04321-002	ASSEMBLY, PUSHER,PLUNGER,LC4200	35
840-04325-002	ASSEMBLY, SUPPORT,SYRINGE, LC4200	36
840-04350-001	ASSEMBLY, SLIDE	37
725-72261-001	TIE, CABLE	38
725-72283-002	MOUNT, CABLE TIE, PLASTIC, ADHESIVE-BACKED	39
721-14033-001	WASHER, LOCK,#4,.025" THICK, SPECIAL CARBON STEEL	40

## Slide Asm



## NOTES:

1 SWAB BEARING AREA WITH ITEM 55 LUBRICANT EACH END

-002

ABBOTT LABORATORIES ABBOTT CRITICAL CARE AND CONTROL SYSTEMS	
SLIDE ASM	
DRAWING NO.	REV. C
247-04350	SHEET 1 OF 1

Table 10-11 Slide Assembly

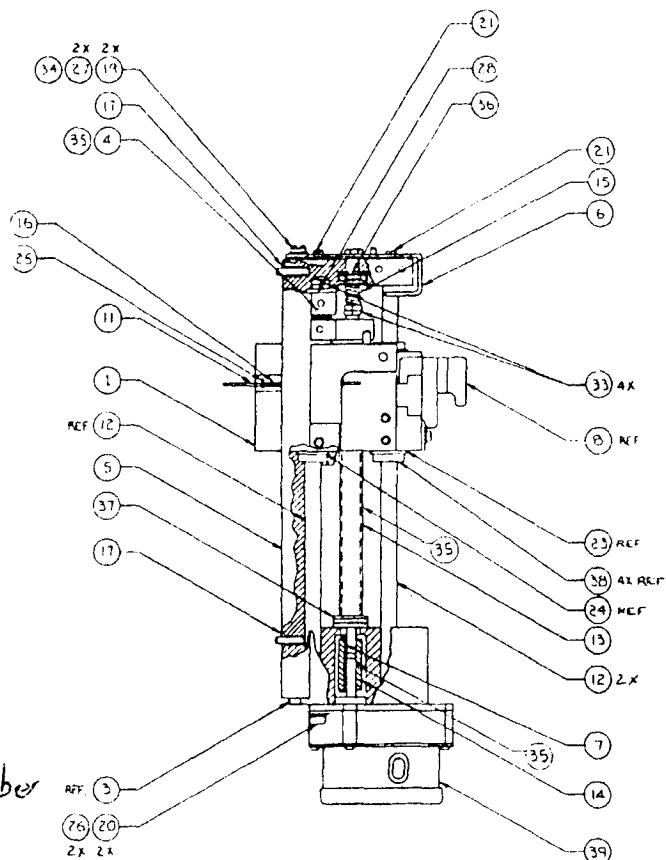
RE: DRAWING NO. 840-04350-002

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
709-04060-003	PLATE, TOP	2
709-04061-003	PLATE, MOUNT, MOTOR	3
709-04065-003	NUT, SPLIT, LEFT & RIGHT	4
709-04327-001	SLIDE BLOCK	1
714-04063-003	ACTUATION SWITCH OCCLUSION	6
714-04087-002	CLIP, COUPLING	7
714-04152-001	ACTUATION-OUTSIDE SWITCH	8
714-04153-001	ACTUATION-INSIDE SWITCH	9
714-04171-002	BRACKET, MTG CABLE, SYRINGE, BODY SENS	10
714-04329-001	BASE, MECHANISM, LC 4200	5
715-04331-001	SCREW, LEAD, 7", LC 4200	13
715-04086-002	TUBE, COUPLING	14
715-04328-001	SHAFT, SENSOR, PLUNGER	11
715-04330-001	SHAFT, 0.25" D X 7.8 L	12
717-23060-001	SPRING, COMPRESSION	15
717-23056-001	SPRING, .088" DIAMETER	16
720-10133-006	SCREW, 8-32X.375, FLAT HEAD, PHILLIPS HEAD	17
720-10137-001	SCREW, 6-32 X 3/8, FLAT HEAD, PHILLIPS HEAD	18
720-10142-003	SCREW, 4-40 X .125", SHOULDER, STEEL	19
720-10155-005	SCREW, 6-32 X 1/2", SOCHD, CA	20
720-10323-002	SCREW, 4-40 X 1/4", HEX HEAD, SLOTTED W/WASHER	21
720-10450-001	SCREW, 8-32 X 1/4", SET, FLT	22
721-13054-001	RING, RETAINING, .500SFT, EX	23
721-13055-001	RING, RETAINING, .500" OUTSIDE DIAMETER	24
721-13110-001	RING, E, 1/16 SFT	25
721-14034-001	WASHER, LOCK, #6, .031" THICK, STEEL	26
721-14142-001	WASHER, SPRING, #5, .004" THICK	27
721-14181-006	WASHER, FLAT, .253" INSIDE DIAMETER, .044" THICK	28
721-14181-007	WASHER, FLAT, .253" INSIDE DIAMETER, .046" THICK	29
721-14181-008	WASHER, FLAT, .253" INSIDE DIAMETER, .048" THICK	30
721-14181-009	WASHER, FLAT, .253" INSIDE DIAMETER, .050" THICK	31
722-12005-001	NUT, 8-32, HEX, STEEL, CADMIUM/ZINC	32
722-12008-001	NUT, 1/4-40, HEX, BRONZE, NICKEL	33
733-35010-001	SEALANT, "VIBRATITE"	34
733-35017-001	LUBRICANT, MULTIPURPOSE, WHITE	35
745-19075-001	BRG, .18X .50X .195THKF	36
745-19075-002	BRG, .25X, .56X .196THK	37
745-19100-001	BRG, BALL BUSH	38
830-04239-001	ASSEMBLY, GEAR, LC 4200	39

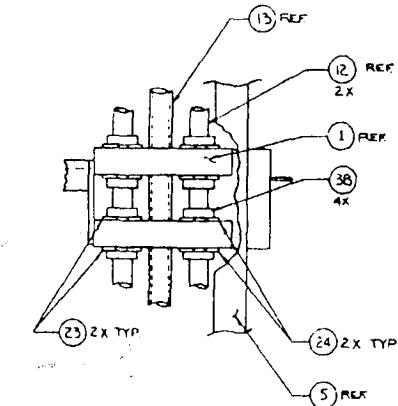
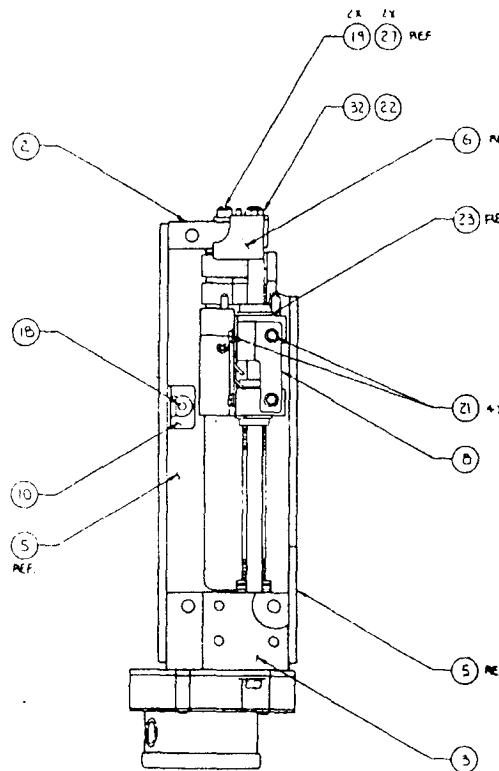
Sept 11, 1987 ABBOTT  
Littoral \$200

Figure 10-12

## Slide Asm



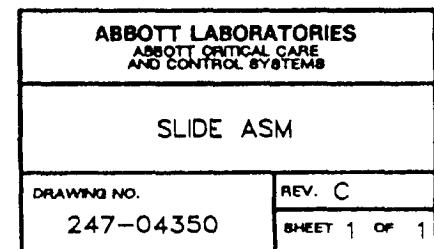
10 part number REF. ③  
just order (76) (20)  
2x 2x  
long for retaining screw case  
rear #  
NOTES:  
1 SWAB BEARING AREA WITH ITEM (25) LUBRICANT EACH END



P/N 840-04350-004 (may not be  
in stock)  
\$ 193.03

Please get the prices of slide assy. and screws with 8cm length for rear case.

Thanks!



LOCK ASSY PN: 04295-022? Date: 119.38 on 25/11/98  
(incorrect infusion rate)

727-04295-001

+

lock

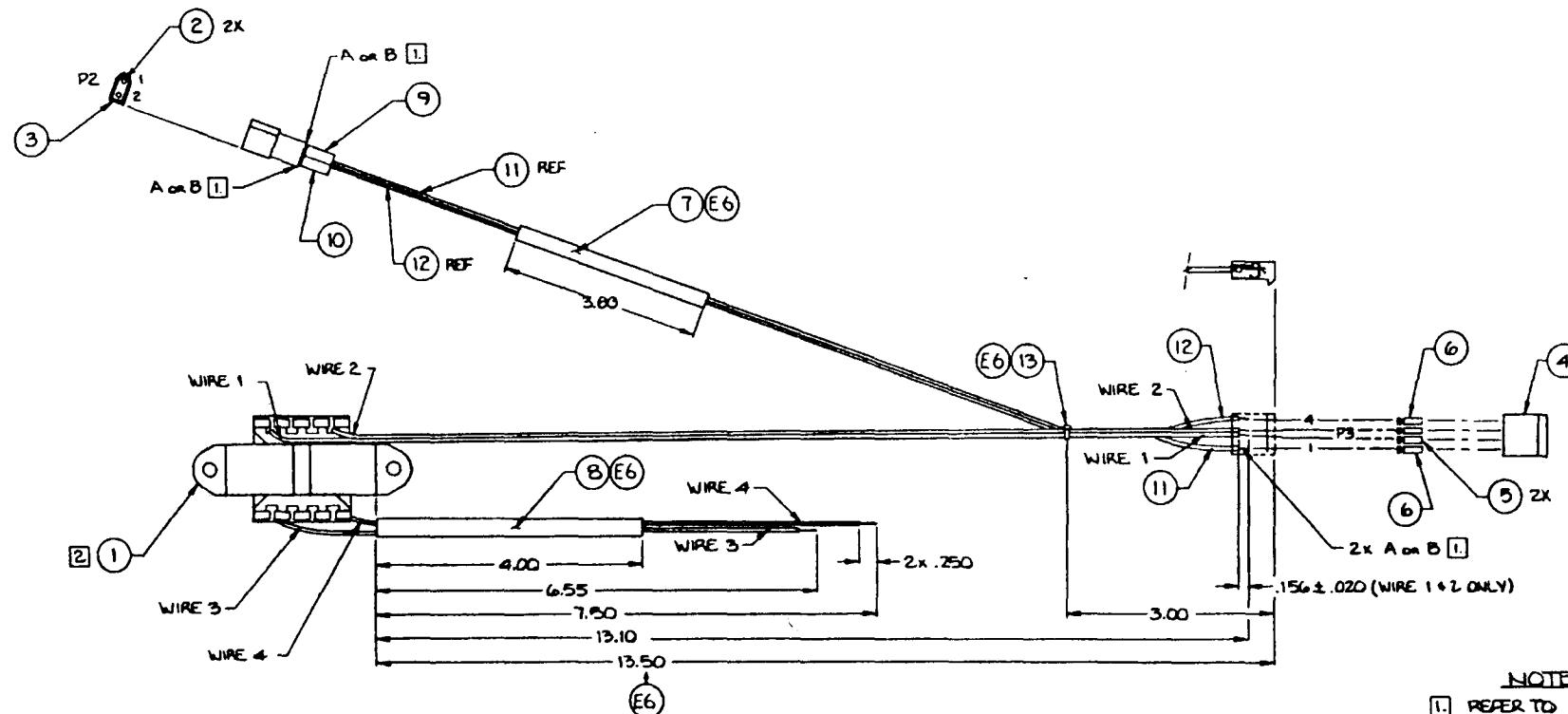
5-002 820-~~421~~

713-7375-004 844-12

840-

04098, 004 844-12

Figure 10-13  
Transformer Asm



NOTES:

- ① REFER TO C15 WIRE CONFIGURATIONS, 681-67250 FOR INFORMATION ON ORIENTATION OF 'A' AND 'B' ENDS OF ⑪ AND ⑫.
- ② ITEM ① SHOWN TOP VIEW. (MOUNTING FLANGE IS DOWN)

100V -002  
220V -001

ABBOTT LABORATORIES ABBOTT OPTICAL CARE AND CONTROL SYSTEMS	
TRANSFORMER ASM	
DRAWING NO.	REV. C
247-04358	SHEET 1 OF 1

Table 10-12 Transformer Assembly

RE: DRAWING NO. 830-04358-001, -002

PART NUMBER	NAME DESCRIPTION	REFERENCE DESIGNATOR
662-69011-004	XFRM, POWER, JAPAN	1
662-69011-005	XFRM, POWER, INT'L	1
668-65107-001	CONT, PIN, CRIMP, GOLD PLATED	2
668-65122-001	CONNECTOR, HSG, MALE, PLUG, 2-PIN	3
668-65132-001	CONNECTOR, HSG, FEM, PLUG, LOCKING, 4-PIN	4
668-65201-001	TERMINAL, CRP, CHAIN, GOLD PLATED, 18-24AWG	5
668-65202-001	TERMINAL, CRP, CHAIN, GOLD PLATED, 18-24AWG	6
680-72582-001	TBG, SHRINK, .125" INSIDE DIAMETER	7
680-72584-001	TBG, SHRINK, 0.187 INSIDE DIAMETER	8
680-72619-001	MARKER, PLRT, TBG, SHRIN (+)	9
680-72619-002	MARKER, PLRT, TBG, SHRIN (-)	10
681-67259-093	WIRE, C/S, 1.281"	11
681-67259-094	WIRE, C/S, 1.281"	12
725-72262-001	TIE, CABLE	13

830-04241 PATIENT SWITCH

713-73576-013 KBY

1-98

**For technical assistance or customer order entry, contact Abbott Laboratories.**

**DANGER: POSSIBLE EXPLOSION HAZARD IF USED IN THE PRESENCE OF FLAMMABLE ANESTHETICS.**

**IEC 601-1 Classification: Class 1, Type B, Drip-proof**

**Medical Equipment**



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